ICE AND REFRIGERATION

ILLUSTRATED

Vol. 5
Nos. 1 to 6

July to Dec.
1893.

H. S. RICH & CO.
PUBLISHERS:
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ICE AND REFRIGERATION ILLUSTRATED

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

VOL. V. NO. 1. CHICAGO: NEW YORK: JULY: 1893. $2.00 PER ANNUM.

[Written for ICE AND REFRIGERATION.]

MECHANICAL REFRIGERATION.*

THE VARIETIES OF REFRIGERATING MACHINES—ALL HAVE THE SAME EFFICIENCY WHEN PERFECT—THE COMPRESSION AND ABSORPTION MACHINES.

BY GEO. RICHMOND, M. E.

REFRIGERATING machinery has a singular variety in outward appearance, mode of action, and in the substances employed as agents, but as the object in each and every one is the same, namely, to remove heat, we are prepared to find that one common principle underlies them all.

An observer cannot fail to notice one characteristic common to all such machinery; and if the apparatus were entirely covered from view, it is certain that he would find high temperature heat, or the means of producing it, going in at one end, and low temperature heat, or substances cooled below the surrounding temperature, coming out at the other. Whatever may be the claims as to the advantage of this or that style, and however mysterious its operation may appear, we could certainly predict that a certain amount of coal would have to be supplied for every ton of ice turned out. Moreover, as we have seen, we can predict further (when we know the temperatures involved) the least possible amount of coal which will be needed, and that without considering the details of the process. This fact is of some consequence, for ingenious men can readily make complex combinations, which it would be very difficult to analyze or examine in detail, the more so as the physical properties involved may be only very vaguely known. The claim in any such case must be limited to the maximum production possible.

Any refrigerating apparatus may be represented by the simple scheme, Fig. 1, in which *A* is a source (namely, the boiler or generator) from which a quantity of high temperature heat, *H*, is supplied, and *B* is a refrigerator from which a certain quantity of low temperature heat, *h*, is drawn. *C* encloses a mechanism of some kind, by the operation of which the double flow of heat is caused to take place; or, rather, by reason of which the flow of heat from the refrigerator is brought about as a consequence of the flow of heat from the generator.

The object of all refrigerating processes is to obtain the greatest amount of refrigeration with the least expenditure of heat; that is, to make the proportion of *h* to *H*, or the fraction $\frac{h}{H}$, as great as possible. In the perfect machine, of whatever type, as will be shown hereafter, these two quantities of heat are directly proportional to the temperatures at which they are supplied, and inversely proportional to the ranges through which they are used.

The general character of the various machines constituting the compensating device *C* must be well known to the reader, and he will find descriptive details of nearly every class in earlier numbers of this journal, and particularly in a series of articles by Mr. A. J. Rossi, running through the first and second volumes. They

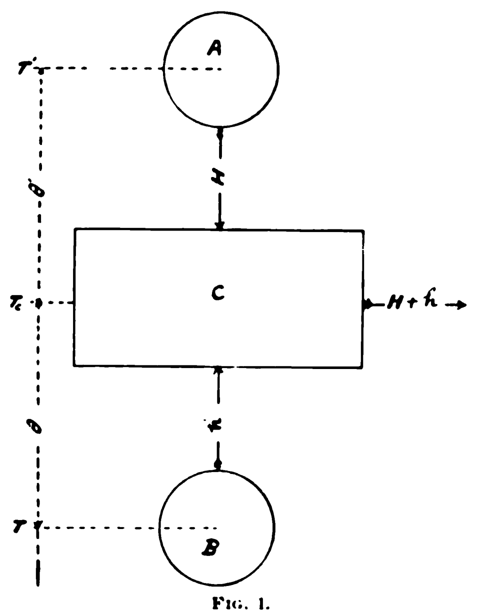


FIG. 1.

may be conveniently classified as follows: I. Compression machines. II. Absorption machines. III. Mixed. IV. Vacuum machines. V. Liquefaction machines. Compression machines may be again divided into: (*a*) Those using permanent gas with open circuit, or closed circuit (*i. e.*, dense air system of L. Allen). (*b*) Those using liquefiable gas, as ammonia, sulphuric acid, carbonic acid, water. (*c*) With or without expansion cylinder. Air machines must and it would seem that carbonic acid ought to have expansion cylinders. (*d*) Those using wet or cold compression, and those running with superheated gas. The former is known as the Linde system, while the latter is in more general use in America.

Absorption machines present an endless variety in details, but the mode of operation in all is very nearly the same, with exceptions that will be noticed in the proper place. One characteristic division is that of intermittent and continuous machines. Another is that of those using liquid absorbents and those using dry absorbents.

Mixed machines are those employing partly compression and partly absorption, such as the machine of Harrison, and, more recently, that of Mr. Thomas Rose.

Under the name "Vacuum," two machines are known, one of which is properly a compression machine using water as an agent instead of ammonia; and the other is of the absorption type, in which water is used instead of ammonia, and sulphuric acid in place of water.

The liquefaction apparatus is that employing the solution of solids more generally known as freezing salts. They are generally intermittent in action, but have been designed to run continuously.

In all these machines it is not difficult to trace the compensation above referred to. It may not be so obvious in the last class, but it must be remembered that in order to get the salt back again into condition for doing more cooling it must be evaporated by high temperature heat. It will be sufficient for our purpose to trace the course of the two quantities of heat in question through an apparatus of the compression type and one of the absorption type.

In the compression machine this is very easy; and in Fig. 2 the essential features comprising the compensator *C*, are sketched in, and are seen to consist of an engine with its condenser and a compressor with its condenser. The heat *H* passes into the engine, where a portion of it, *W*, is converted into work, and the remainder *H*—*W*, passes into the engine condenser (which in the case of a non-condensing engine is the atmosphere). The work *W* is transferred to the compressor

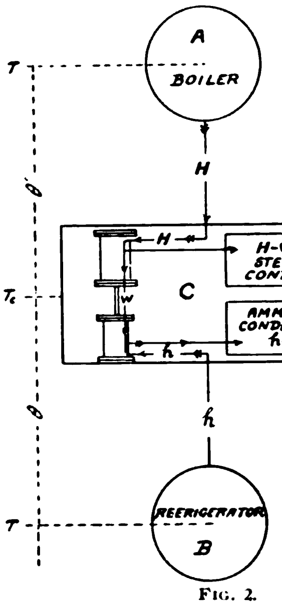


FIG. 2.

and the heat *h* from the refrigerator flows through the compressor, and carries with it the work *W* in the form of heat into the ammonia condenser, so that the sum of the discharged or rejected heats is $H+h$, in accordance with the general scheme, Fig. 1. We see now why the flow of high temperature heat causes the flow of low temperature heat, and also, from Fig. 3, the relationship which must obtain between these two quantities.

In Fig. 3 (*a*) the larger rectangle represents a quantity of heat, *H*, the height being the absolute temperature, *T'*, at which it is supplied, and the smaller rectangle the work which can be obtained from it, while θ' is the fall of temperature utilized, *i. e.*, the difference in temperature between the boiler and engine condenser. The equal width of each rectangle is marked ϕ', and we shall in future indicate the width of any heat area by this

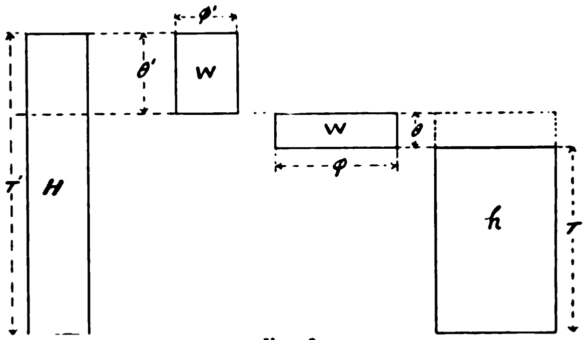


FIG. 3.

letter. Since rectangles, having equal widths, are proportional to their heights, we have:

$$W : H : : \theta' : T'$$

$$\text{or} \quad \frac{W}{H} = \frac{\theta'}{T'} = e \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(1)}$$

In Fig. 3 (*b*) in the same manner the quantity of heat, *h*, removed from the refrigerator is represented by a rectangle whose height is equal to the temperature (absolute) of the refrigerator from which it is taken, and θ is the rise in temperature through which it is lifted, *i. e.*, the difference in temperature between the ammonia condenser and the refrigerator.

As before, we have, inverting the proportion:

$$h : W : : T : \theta$$

$$\text{or} \quad \frac{h}{W} = \frac{T}{\theta} = e_1 \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(2)}$$

If we multiply together the equations (1) and (2), noticing that the *W* will cancel, we have:

$$\frac{h}{W} = \frac{T}{T'} \times \frac{\theta'}{\theta} = e \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(3)}$$

which proves the general statement with which we set out, so far as the compression machine is concerned. The work done by high temperature heat is equal to the work done on the low temperature heat, and each may be written down as the product of the two sides of the respective work rectangles, that is:

$$W = \theta' \phi' = \theta \phi \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(4)}$$

If the width ϕ' represent a weight of water and θ' the distance through which it can fall, then the work done would be $\theta' \phi'$ foot-pounds. Again, if ϕ represent another weight of water and θ the distance through which it is lifted the work necessarily expended is $\theta \phi$ foot-pounds, and, if we had perfect machinery, these two quantities must be equal to enable us to lift the maximum amount of water for the least amount allowed to flow down.

From these hydraulic analogies, Zeuner has termed the width of the heat area the "heat weight."

When the converter *C* is an absorption machine it is more difficult to trace the course of the two quantities of heat. Stripped of all details the main features are represented in Fig. 4. There is the same general condition of high temperature heat supplied and of low temperature heat flowing to a higher temperature, but there is no trace of work obtained or work performed,

Yet, while it is not recognizable, we know that the transfer of low temperature heat could not take place without the equivalent transfer of the high temperature heat. Moreover, in practice we find that the quantity of heat discharged into the ammonia condenser is approximately the same as that discharged in the compression machine, and the heat discharged from the absorber approximates to that discharged by the engine condenser.

Following the agent as it travels around, the peculiarity of the absorption machine seems to be that it discharges the heat due from the refrigerator and the heat equivalent of the work necessary for the refrigeration in advance of the actual performance of the refrigeration. Thus, as figured above, if H is the heat leaving the generator $h+W$ of this is discharged in the ammonia condenser and $H-h-W$ goes forward with the ammonia to the refrigerator.

We may conceive that the ammonia carries with it a draft drawn by the generator on the refrigerator for the amount of heat h to cover what has already been advanced on its behalf. Accordingly the refrigerator honors the draft by supplying the quantity of heat h, and the ammonia goes forward to the absorber where it

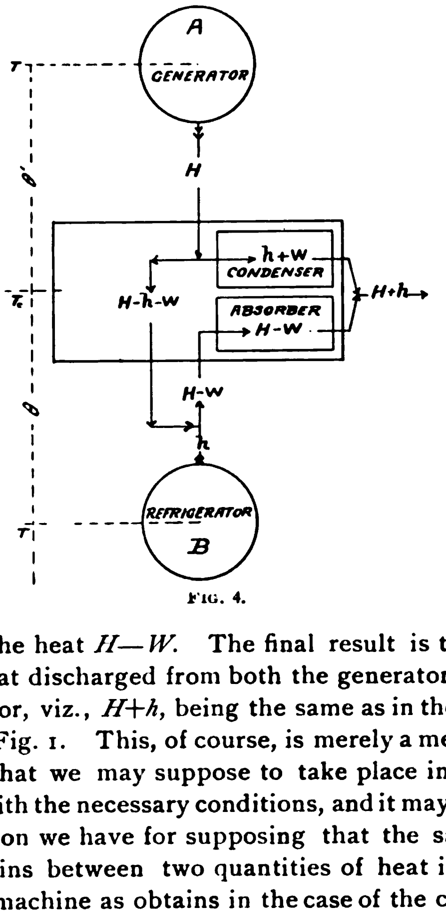


FIG. 4.

delivers the heat $H-W$. The final result is the same, all the heat discharged from both the generator and the refrigerator, viz., $H+h$, being the same as in the general scheme, Fig. 1. This, of course, is merely a mental picture of what we may suppose to take place in order to comply with the necessary conditions, and it may be asked what reason we have for supposing that the same relation obtains between two quantities of heat in the absorption machine as obtains in the case of the compression machine. In other words, is equation 3 necessarily true for the absorption machine?

This is a most important matter, the more so as its denial is implied in some explanations of the absorption machine by authorities entitled to the highest consideration. Suppose that it is not true, and that we have two machines working with identical temperatures and ranges, but one on the compression plan and the other on the absorption, and that they both receive the same supply of high temperature heat, namely H, but that while the compression machine furnishes h *T. U.* of refrigeration the absorption machine furnishes a larger amount, say $2h$. Let the refrigeration $2h$ be represented by a certain quantity of ice, and let us remove it from the absorption machine and place it in the refrigerator of the compression machine (supposed to have lain idle up to the present), which will now have a stock of ice representing a capacity for absorbing heat to the amount of $2h$. Now let the compression machine be reversed. Let the compressor be changed to an engine, and the engine to a compressor. The ammonia can be boiled in the ammonia condenser, and will pass through the ammonia engine; the refrigerator will be a surface condenser for it until all the ice has melted or the quantity of heat $2h$ has been supplied. When this happens the ammonia engine will have furnished work to the steam compressor equal to $2W$, but one of these is sufficient to cause the passage of heat $H-W$ backward to the boiler, and being itself transformed into heat the boiler will receive in all H units of heat. The position we are now in is this: We have imparted to the boiler a quantity of heat, H, and we have quantity of work W left over. The heat H can be transferred to the absorption machine, where it will again produce $2h$ of refrigeration, so that as a final result we have the quantity of work W produced at each operation free of cost without the expenditure of any heat at all. Since we cannot admit this possibility we must believe that the absolute efficiency expressed by equation 3 is the greatest that any refrigerating machinery can have, whatever the nature of its details may be.

On the other hand, the temperature and ranges being the same, no reason can be assigned why any other type of machine should not have precisely the same efficiency. The compression machine was chosen as the standard simply because it is easily seen how it can be reversed, for it is evident that reversibility is the true test of our having found the correct statement of the law governing the equivalent transfer of the two quantities of heat, which law must be independent of the mechanism employed.

[TO BE CONTINUED.]

A BOSTON paper (think of it) has made the unpardonable *faux pas* of saying that "the announcement of a formation of an ice trust has undoubtedly sent a cold chill up the back of many a consumer." Take any shape but that. Call it red hot, a boiling flood, a—anything but a cold chill. What's the use of having an ice trust if the mere announcement is going to chill the consumer? The ice man gives it to 'em hot, don't you know.

THE information comes from Ellensburgh, Wash., that four years ago some citizens built an ice house on the Nanum and filled it with ice of an excellent quality. The ice was put up as a reserve, and it has kept as a reserve, notwithstanding the roof and sides have been wrecked. There are tons of it still imbedded in the sawdust, fresh and solid as when taken from the pond. Nothing seems to be impossible "in this glorious climate" of Washington!

——The business of C. G. Mayer, 744 Broadway, New York, builder of ice machines, has been incorporated at Newark, N. J., as a stock company, to be known as the C. G. Mayer Ice Machine Co., capital, $50,000, fully paid up. John Enright, Albert W. Jacobs and George W. Wiedenmayer, of Newark, and Charles G. Mayer and Julius J. Mayer, of New York are the incorporators.

[*Reprint from unidentified* EXCHANGE.]

FREEZING MIXTURES.

SUBSTANCES WHICH MAY BE EMPLOYED FOR LOWERING TEMPERATURES—SOME FAIRLY EFFECTIVE FREEZING MIXTURES—MANUFACTURE OF ICE BY THEM A FAILURE.

THE numerous and varied applications which ice has found in these times have greatly enhanced the importance of that product, and while large portions of it have annually been transported from the colder to the hotter regions of the globe, scientific ingenuity has attacked, energetically and successfully, the problem of producing cold by artificial means for industrial and other purposes. In a recent number of *Dingler's Polytechnisches Journal*, Professor Meidinger has an instructive paper giving an account of the progress made in recent years in the art of ice manufacture.

There are three ways indicated by physics in which temperature may be lowered, and ice formed, viz., solution of solid substances, evaporation of liquids, and expansion of gases. The following is an abstract of that portion of Professor Meidinger's paper relating to production of cold by solution:

Heat is absorbed in bringing solids to the liquid condition; and the cold thus produced may prove sufficient to convert water into ice.

The best known of the numerous freezing mixtures that have been hitherto described is, of course, one involving ice itself; it consists of three parts of ice and one part of ordinary salt.

Dissolving concurrently, these two substances give a temperature of —21° C. (the freezing point of the solution). The melting of only a part of the mixture is sufficient to produce this temperature throughout the mass; and with constant admission of heat, and stirring, the low temperature is maintained until the whole is dissolved. The freezing apparatus of confectioners is well known: a tin pot containing cream, a wooden or metallic vessel inclosing the pot, and the interval filled with ice and salts, which is frequently stirred, that the ice may not sink to the bottom. In a Paris machine for home use the agitation of the freezing mixture is maintained by rotation of the double cylinder containing it and the cream vessel round an axis at right angles to the cylinder's length. Professor Meidinger has constructed a machine based on the observation that a solution of ordinary salt under 0° also fuses ice, and, so long as its concentration is maintained, produces the same low temperature as the mixture of salt and ice. He provides a sieve-like vessel, containing salt, to maintain the concentration as the ice melts. The lowering of temperature is uniform throughout the vessel, and no stirring is required. The machine has come largely into use in perfumery.

On the basis of his own experiments, Professor Meidinger has formed a table showing the respective merits of various freezing mixtures. The table in the next column contains the most serviceable.

Salt mixtures give much greater lowering of temperature than simple salts, as they dissolve in much less water. Thus one part of sal-ammoniac is dissolved in three parts water, and lowers the temperature about 19°; saltpeter dissolves in six parts water, and lowers the temperature about 11°. (Compare the fourth and fifth on the list.) It will be seen that the salt-ice mixture proves considerably more energetic and cheap than any of the others, so far as use of the materials only once is concerned. The second mixture, too, cannot be restored; nor can the last, easily, on account of the crys-

MIXTURE.	Decrease of temperature.	Specific heat of the solution.	Volume weight of solution.	Loss of heat unites.		To use for 120c.		
				1 k. Mixture.	1 l. Mixture.	Salt k.	Water k.	Cost in Marks.
1 ordinary salt, 3 ice	21°	0.83	1.18	125	100	0.5	1.5	0.34 to 0.12
3 cryst. Glauber salt, 2 concd. muriatic acid.	37°	0.74	1.31	55	74	2.7	1.8	1.0 to 0.6
2 nitrate of ammonia, 1 sal ammoniac, 3 water................	30°	0.70	1.20	42	51	3	3	7.6 to 6.8
3 sal ammoniac, 2 saltpeter, 10 water	26°	0.76	1.15	40	46	2.1	4.2	2.6 to 2.2
3 sal ammoniac, 2 saltpeter, 4 cryst. Glauber salt, 9 water...	32°	0.72	1.22	50	61	2.5	2.5	1.8 to 1.6

tallized Glauber salt. Both are comparatively cheap, however. The mixture in which, by vaporization of the solution, the salt is easily renewed in its original condition, nitrate of ammonia and sal ammoniac, is so costly at the first that it would not do to use it only once. This was the mixture employed in an apparatus first exhibited by M. Charles at the Paris Exhibition in 1867. The tin vessel containing the substance to be frozen is inclosed in a large wooden vessel containing the freezing mixture, and is furnished with screw wings, which stir the mixture as the vessel is rotated. Another form is that of Toselli's glacière Italienne roulante. The cream or other such substance is enclosed in a conical-shaped vessel suspended in the freezing mixture, and the outer vessel, enveloped in cloth, is rolled to and fro on the table. None of these machines have found very extensive use. Large masses have to be operated with to obtain even small results, and the sum of operations must generally prove too troublesome in a private house.

As to the question of manufacturing ice on a large scale by means of solution of salt, Professor Meidinger comes to the conclusion that by means of 1 kilog. of coal (for restitution of salt used) not more than 2 kilogs. of ice can be prepared; not to speak of the machine force required for transport of the large quantity of liquid. This is very unfavorable; an ammonia machine will give four or five times better results. Much improvement is, in the circumstances, hardly to be looked for. It would be necessary to find a salt that, in dissolving, gave a much greater lowering temperature than the mixtures known, and this cannot be expected, since all the known salts have been examined in reference to this point. The real cause of the small productions of such apparatus lies in the fact that restitution of the salt is effected only by change of aggregation (vaporization), and this involves large expenditure of heat. It may be mentioned that, according to experiments by M. Rudorff on cold produced by solution of twenty different salts, the two which gave the greatest lowering of temperature were sulphureted cyanide of ammonium, and sulphureted cyanide of potassium—105 parts of the former dissolved in 100 parts water produce a lowering of temperature of 31.2°; and 130 parts of the latter in 100 parts of water as much as 34.5°.

——The Hygeia Ice Co., New Haven, Conn., has established a distilled water and ice agency at West Haven.

——The Marion (Ohio) Ice and Cold Storage Co. are having a lucrative trade in distilled water, and are running one wagon for that trade exclusively.

[Written for ICE AND REFRIGERATION.]

CONSERVATION OF MEATS.

PRESERVING FRESH MEATS AS INVESTIGATED ON THE CONTINENT OF EUROPE—PARISIAN BUTCHERS' COLD STORAGE—INSTALLATIONS OF COLD STORAGES, SECOND TYPE.

By AUGUSTE J. ROSSI, B. S., C. E.

[*Continued from May number, page 370.*]

ANOTHER typical disposition is that of Mr. Velly, one of the principal wholesale butchers of Paris. The circulation of the air is obtained, as in the Schroeder system, without the use of any mechanical device, merely by the difference of specific gravity of the cold and warm air, the refrigerating room being likewise distinct from and immediately above the meat room; but the manner in which the air is cooled is characteristic. It makes of this installation a distinct type, and, for this reason, though of a comparatively secondary importance as to extent, it will serve as a good illustration of another example of continental practice.

As in the cold storages of Geneva and Mulhouse, the freezing of the meats is avoided and the temperature maintained in the rooms is only of 2° to 4° C. (35° to 38° F.) The rooms can store thirteen to sixteen tons, 26,500 to 31,000 pounds of meat; their dimensions being thirty-nine feet long by twenty-one feet wide, by ten feet and six inches high; this gives, for the total capacity, 8,600 cubic feet, passages included. Assuming, agreeing to the rule laid down by the commission in such cases, an amount of four pounds of meat per cubic foot of contents, 8,600 cubic feet multiplied by four pounds would give 34,400 pounds as the capacity in stored meats of the room; actually there are 27,000 to 31,000 pounds stored; and we are within the margin, with ample allowance for the facility of the service.

The walls of the meat room are of stone, twenty inches thick. At a distance of four inches from the stone wall, a brick wall, four inches thick, has been built, and the space between the two walls, filled with cork shavings.

The brick walls, on their inside face in the storage, have been cemented to a height of about six feet all around, and, in order to admit of a thorough washing, the floors have been asphalted. The number of windows has been reduced to the minimum consistent with the necessities of light for the service; and are made of three glass sashes to avoid, as much as possible, the loss of cold on this score.

The ceilings are made of brick arches and iron I beams, covered, first, with a layer of six inches of cork shavings, then with one of clinkers or cinders, four inches thick; over this is applied a bed of concrete, made with clinkers, four inches thick; and the whole has received a thick coating of asphalt. Ventilator shafts *T T*, opening on the roof, and provided with registers inside to regulate their action, permit the introduction of fresh air or evacuation of the vitiated air, whenever it is considered advisable.

Immediately above the cool room *R'* is the refrigerating room *R*. It extends in the whole length of the storage, but covers only a part of it in the width, some ten feet or thereabout. Instead of the troughs and of the spray of brine resorted to at the Mulhouse and Geneva markets to cool the air, a system of coil pipes, very much like the refrigerator or expander of an ice machine, has been used for the purpose. In this coil circulates the brine, made cold in separate tanks in a special part of the building devoted to the machinery by the action of the refrigerating machine.

There are, in fact, two distinct systems of coils (see plan, Fig. 3; section *A B*, Fig. 2), at a certain distance from but communicating with each other, the circulation of the brine being continuous from one to the other, their total length is about 2,000 feet. This disposition facilitates the repairs in case of need, as well as the cleaning of the surfaces. The circulating brine is cooled to such a temperature as may be found proper to obtain the necessary cooling of the amount of air which comes in contact with the piping. In this case, the temperature of the brine is —10° C. (14° F.).

Particular care has been taken to thoroughly insulate this refrigerating room *P*. The sides are made of two wooden partitions, built with tongued and grooved pine boards, ten inches apart, the space between them having been filled with cork shavings, or such other appropriate insulating materials; the ceiling has been insulated in the same manner, and, on the upper boarding, under the roof proper, a thick layer of cork shavings has been spread loose all over. The floor which forms the ceiling of the meat room has been constructed as already described. The circulation of the air is induced by the

difference in the specific gravities, as in the first type. The air, cooled by its contact with the cold pipes of the coils, in the interior of which circulates the cold brine and on the surface of which it deposits as frost the moisture and the germs with which it may have charged itself, becomes heavier; it descends through the five central flues *F*, constructed in the floor in the meat room, circulating freely around the meats placed in proper compartments or stalls, thereby getting warmed up and saturated with moisture at the expense of the watery constituents of the meats, and becoming thereby lighter, ascends by the lateral flues *C C C* to the refrigerating room, to be there cooled again and deprived of moisture before it returns to the storage rooms.

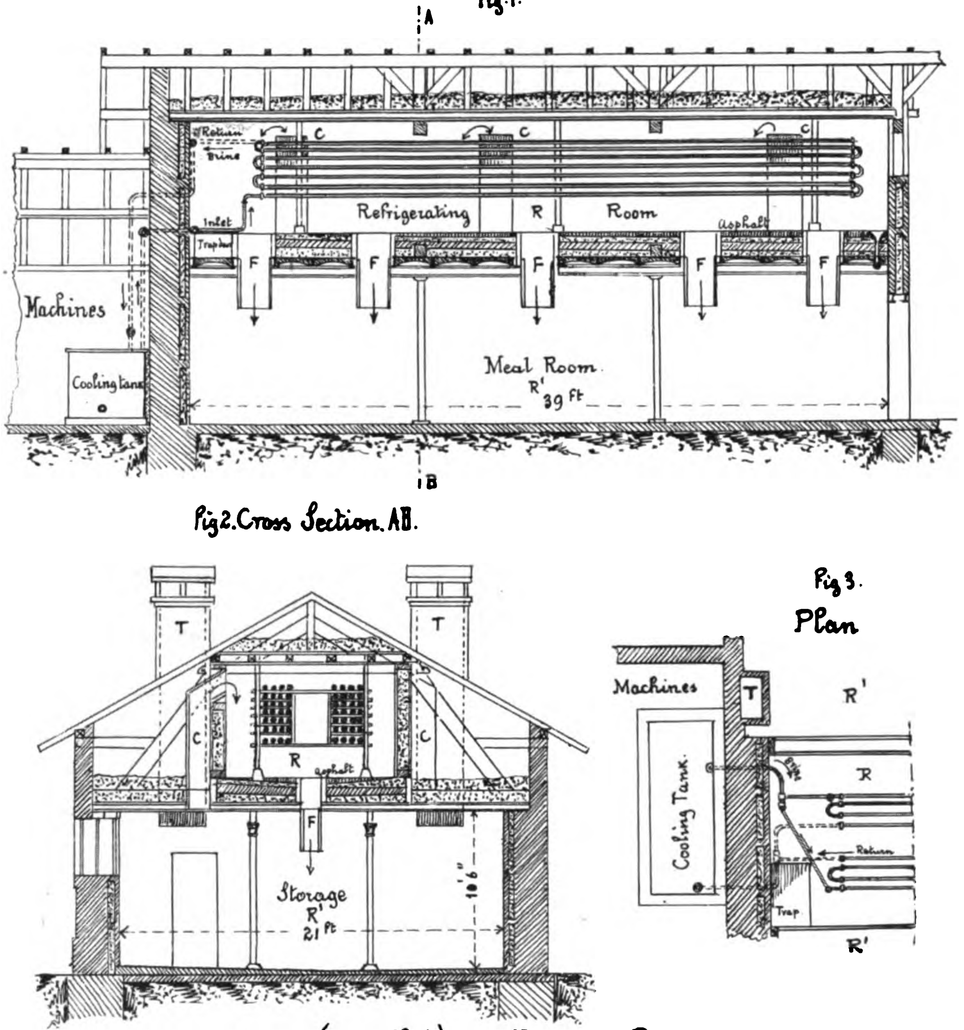
The velocity of the current is necessarily very small, thus insuring a thorough and gradual cooling and desiccation of the tissues—conditions important, it is stated, to obtain the most satisfactory results.

The figures 1, 2, 3* show the general arrangement of the different rooms and relieve us from any lengthy description. We intend to present only such details as may be more characteristic of this system. It is obvious that, with such a coil, the moisture of the air must be condensed in the state of frost on the surface of the iron pipes, and that this frost, increasing in thickness as the operation proceeds, acts as a non-conducting substance to diminish the transmission of cold from the brine to the air, thus requiring from the machine a greater production of cold than would be necessary to insure a given result in a given time. In this particular case, the refrigerating machine being ample for the service and not working constantly, time could be taken to thaw out the condensed moisture which is collected in a proper gutter placed immediately under the coil, the resulting water being drawn off by a special pipe. The floor being asphalted and slanting, any drippings which might chance to fall on it could also be readily disposed of. But there are some cases when the machine may be required to work day and night and continuously for several days. A special disposition has been adopted in this cold storage in view of such possible eventualities. By a special device and the working of two cocks the brine can be evacuated and the frost thawed out, it is said, in less than ten minutes of time. The fact remains, however, that the ice machine has accumulated this frost on the pipes to no useful purpose; rather, the contrary. We will have to speak further, in describing a third type of cold storage, of a contrivance intended to utilize this very frost for the purpose of cooling, while at the same time getting rid of it. Instead of the brine being used as the agent of refrigeration in the coils, it is obvious that there could not be any objections to expanding directly the volatile liquid in the coil itself, as it is done in cellars of breweries by certain systems of ice machines, preserving at the same time the other characteristic features of this type. We may make here a remark in passing, that the lower the temperature at which the air will have to be circulated around the meats,—and in the case of the congelation of the latter it has to be very low and greater unless some remedy be afforded,—the greater will be the objection to the condensation of the moisture as frost on the cold metallic surfaces as taxing unduly the refrigerating machine. In the Schroeder system this is avoided, but the system may present objections of another kind on which we will not insist at this stage of our examination. We should not forget to mention that in all the cold storages we have described, as well as in those which follow, the refrigerating machines used are all of the class in which the mechanical exhaustion and compression of the vapors of a volatile liquid is resorted to as the agent for the production of cold.

Longitudinal Section. Fig. 1.

Fig 2. Cross Section. AB.

Fig 3. Plan



(Mr Velly's) Cold Storage. Paris.
2d type.

A cold storage of the same type has been erected at Tunis. In certain seasons the temperature of the air there remains during the day between 40° and 50° C. (104° and 122° F.), not going below 30° C. (86° F.) dur-

* These figures and the following are taken from "Genie Civil."

ing the night! The cold storage has two stories; one, a basement, is reserved for fish room and cellars for wines and beers. The meat room is on the first floor. It can store 22,000 pounds or eleven tons of meat. The steam engine has a power of 50-horse power, and the ice and refrigerating machine a capacity of 14,000 thermal units per hour. A certain amount of ice is made by the machine, and finds there a ready sale. As this cold storage does not present any special feature, we will limit ourselves to this simple mention, inserting only on this point: "The temperature in the storage rooms is maintained above freezing point."

THIRD TYPE.

That which distinguishes this class of cold storages, and makes of it a special type perfectly distinct from the two others, is: *First*, That the circulation of the air in the meat rooms is obtained artificially by a mechanical device, a blower, instead of being produced naturally by the difference in the specific gravity of air at different temperatures. *Second*, Though the air be cooled, as in the second type, by contact with metallic surfaces, the mode of cooling these surfaces is essentially characteristic; the brine is dispensed with, and recourse has been had to the direct expansion of the volatile liquid itself in the coils as the agent for production of cold. The air cooler corresponds, in fact, to the "refrigerator" in the system of ice machines in which brine is used as an intermediary mode of transmission of cold; in other words, it represents the pipe system of a cellar in which ammonia is directly expanded, with this difference, that the cooling operation takes place in a separate room and not in the meat room itself. *Third*, Finally, in all the installations of this type a special arrangement of this direct expander, or air cooler, has been adopted, by means of which the objections resulting from the condensation of the moisture as frost on the cold pipes are obviated. We will first make a cursory review of a few cold storages of this kind on the Continent, reserving for the last the most important of all, which we will choose as a model of the type, illustrating its principal dispositions by figures, before proceeding to describe, with some details, this system of special air cooler in which the formation of the frost on the pipes is taken advantage of to contribute to the cooling of the air, at the same time getting rid of the frost itself.

At Lisbon the cold storage has been established in an old powder house, the walls being forty-two inches thick, insuring, of course, all the insulation desired. In Portugal fish forms the basis of the alimentation of a certain class of the population, and fishing one of the national industries. The introduction of cold storage for the preservation of this article of consumption has been a source of wealth for the country. Fish, thus preserved, have been transported in refrigerating cars to the markets of Madrid, a transit of twenty-four hours, without being "beheaded," a practice which was rendered necessary previous to the use of artificial refrigerators on account of their unsightly appearance.

"Fish suffer less from congelation than meat does," as far, at least, as retaining its palatable qualities, says Mr. Tellier; but it cannot be preserved for such long periods as meat for two reasons: *First*, the eye dries up and loses its shining appearance after too long an exposure to cold. *Second*, if frozen, the skin, being less elastic, gets hard and is detached from the flesh. But "if the lowering of temperature is limited to 34° F.," or thereabout, and the time of preservation reduced to about three weeks, "both the merchantable quality and appearance of the fish are retained." At Lisbon the cold storage is established on the principles of the third type. The circulation of air is obtained artificially by means of a blower, the temperature in the room not being allowed to reach below 32° F.

At Brussels the cold rooms are constructed below the market, in the basement. The storage has a capacity of 175,000 cubic feet, covering in all a surface of 325 feet by 115 feet. Elevators take the meats and other stored articles to and from the level of the market proper. The refrigerating machine makes both ice and cold air, condensed water being used for the ice. The air cooler is of the peculiar type we have mentioned and which we will describe further. As in the second type, the air is cooled by its contact with cold metallic surfaces, and, as in the two first types examined, this cooling is done in a special and distinct room, but with this difference, that, contrary to what is done in the two first cases, this room has no communication whatever with the meat rooms; it is entirely distinct and may be even at a certain distance therefrom. This remark applies also to the Lisbon cold storage. The warm air is continuously exhausted from the meat room by means of a blower which forces it through the cooling apparatus, discharging it, cold and dry, in the meat rooms, to be returned again to the cooler, when warmed up, by the action of the blower. At Brussels, 1,000,000 cubic feet of air are thus cooled and passed through the storage per hour, the temperature of the air being maintained above that of the freezing point (34° to 36° F.). The cold rooms are divided into three parts; the first, forming a sort of "ante-room," is intended for those products which do not require a great lowering of temperature, and which can be kept for a day or two without danger at a temperature of 44° to 45° F. (+7° to +8° C.) as long as "*the air is dry.*" In the second are stored the meats and those other articles which require a temperature of +2° to +3° C. (35° to 37° F.) to insure their preservation for a certain time. The third room is intended for salt meats, a special space being reserved for what is called there "German beers," which arrive in casks at Brussels in refrigerating cars—all articles which it is advisable to maintain at the low temperature of 35° to 40° F., until they can be dealt to the consumer. The whole storage is lighted by electricity.

[TO BE CONTINUED.]

THE proposition of the city council of Newark, N.J., to exact a license fee from ice dealers in that city is not an encouraging one, but the legitimate dealers say they are willing to pay a license fee if the city will prohibit other people from selling ice. The fees would have to be fixed as high as $50 or $75 to keep junk dealers and others, who now sell ice, from competing with regular ice men. There was opposition in the committee to a high license on the ground that it would give ice dealers a monopoly.

——The Central Ice Co. is a new firm in the ice trade at Los Angeles, Cal., who will sell only manufactured ice.

——The Lauer Brewing Co.'s Park brewery, Denver, Colo., has just been equipped with two De La Vergne refrigerating machines, each of thirty tons capacity.

[*Abstracted for* ICE AND REFRIGERATION.]

A LEGAL DECISION.

LIABILITY FOR LOSS OF HORSES HIRED FOR CUTTING ICE—THE QUESTIONS OF NEGLIGENCE AND VALUE OF SAFETY FENCES AND APPLIANCES FOR RESCUES.

SEVERAL questions of interest have been passed upon by the Supreme court of Wisconsin, in the case of *Stacy* v. *Knickerbocker Ice Co.*, which was brought to recover the value of horses killed through the ice company's alleged negligence.

The ice company had hired a span of horses to be used in its business of cutting and removing the ice formed in Fowler lake. The only express stipulation in the contract of hiring was that the horses should be driven by a certain person. In all other respects the conditions and obligations of the contract were those, and those only, which the law implies. One of these, says the Supreme court, is that a person who hires another's property is only liable for the consequences of the want of ordinary care of the property hired, which in this case was the span of horses. If such property is injured or lost while in his possession, without negligence or fault on his part, the loss falls upon the owner, and not upon him.

In three particulars it was contended that the ice company was negligent, which negligence caused or contributed to the loss of the horses: (1) It failed to indicate the location of the thin ice by a fence, as required by statute; (2) it failed to notify the driver of the horses of the location of the thin ice; and (3) it failed to have ropes and appliances at the place of the accident to be used in getting the horses out of the water before they drowned. But the testimony showed that had all these precautions been taken they would not have saved the horses. (1) They were uncontrollable; were rearing and plunging and getting away from the place where they became frightened as rapidly as they could. The fence of the statute (which is a single fence board nailed on 2×4-inch posts, 3½ feet from the surface upon which the posts stand) would have been but gossamer before those powerful horses, frantic with fright, upon whom two strong men could make no impression. Besides, it is very doubtful whether the statute has any application to this case, inasmuch as the employes of the ice company were then actually engaged in removing the ice adjoining the place covered by the thin ice, and it would seem impracticable to place and keep a fence around the margin of the opening before the work there should cease. (2) Exact knowledge by the driver of the horses of the location of the thin ice was not a possible factor in the loss of the horses, for, had he been fully advised where the thin ice commenced, he was powerless to prevent the horses going upon it. He went into the water with them, and was rescued. Were he suing the owner of the horses for negligence, there would be a case where the fact that he had not such knowledge might be material, but is not material here. (3) We are aware of no rule of law, continues the court, which required the ice company to have, at the place and time of the accident, ropes and appliances suitable for use in hauling the horses out of the water. Moreover, had such ropes and appliances been there at the time, the proof is quite conclusive that they would have been of no avail. The horses fell into deep water and went under the ice, and were undoubtedly dead when the bystanders had succeeded in rescuing the driver, who came near being drowned. It is perfectly obvious that the horses would not have been drowned had they not become frightened and uncontrollable. For such fright no blame attaches to the ice company. Had the driver of the horses been able to keep the horses under control, he would not have been required to go upon or dangerously near the thin ice, for the scraping he was sent to do, and which the horses were hired to do, was at a point safely distant from the thin ice, and the distance therefrom would have constantly increased as the work progressed.

Whereupon the case presents no testimony which would warrant a finding that the ice company was guilty of any negligence whatever which caused or contributed to the loss of the horses, and the judgment of the Circuit court throwing their loss upon the owner must be affirmed.

MINOR LEGAL NOTES.

——Washington Butcher's Sons, wholesale dealers in provisions and cold storage at Philadelphia, June 6, made an assignment to Geo. W. Lex.

——The Arctic Machine Manufacturing Co., Cleveland, has recovered a judgment versus Daniel Duty, and others, of Cleveland, for $7,599.90, part of purchase price of an ice machine. Motion for new trial made.

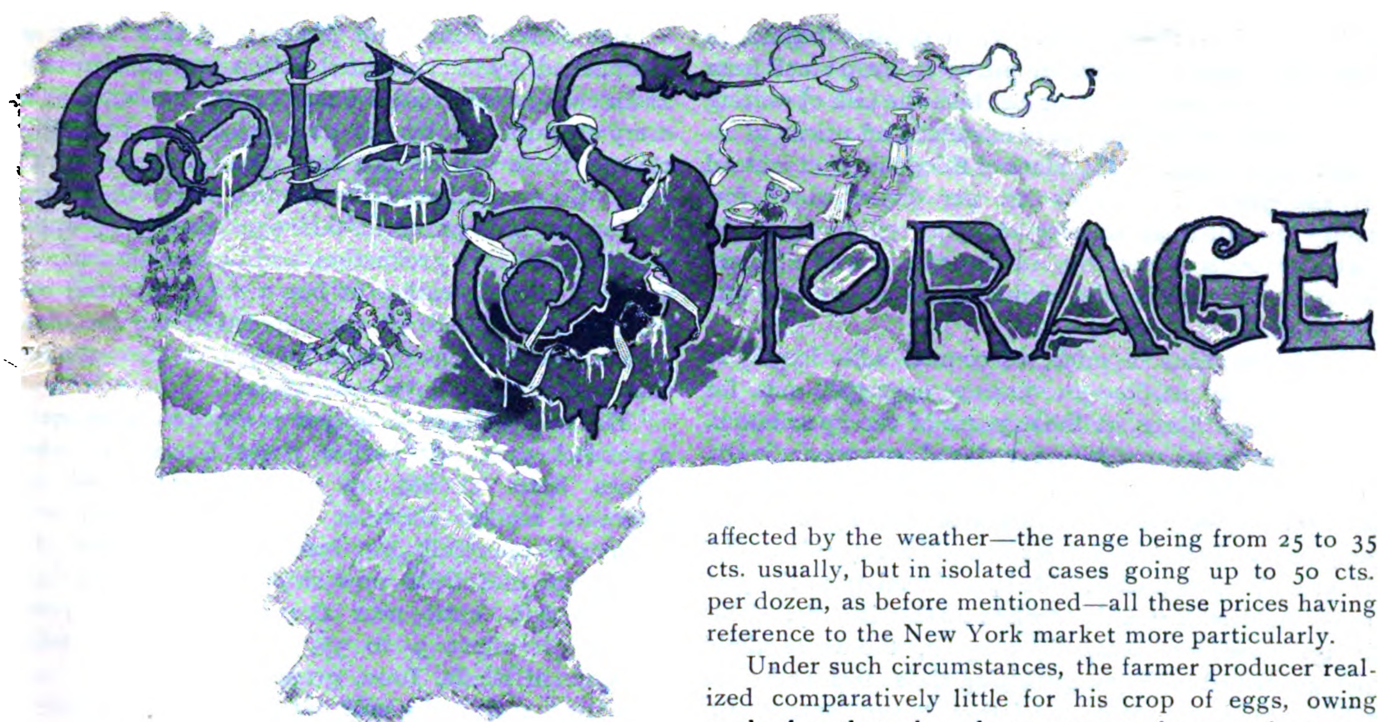
——Noah Music, an employe, stepped into a kettle of boiling water some time ago at the Jacob Dold Packing Co.'s plant, Kansas City, and scalded his right leg. He sued for $2,000 damages, and the jury gave him $1,500.

——The Independent Ice Co., Chas. and Wm. Bannon, of Richmond, Ind., has gone out of business, owing to the fact that the company could not ship ice into this city from the lakes and sell at a profit in competition with the Union Ice Co.

——John Moody, of the Tahoe Ice Co., Reno, Nev., has secured a judgment versus the Union Ice Co., of San Francisco, for $23,123, for damages sustained by the failure of the Union company to take the ice put up by the Tahoe company according to a contract entered into between the two companies.

——Joseph P. Fisher, Hamilton, Ohio, June 7, filed a petition praying for the appointment of a receiver and for closing up the business of the Standard Ice Tool Co., of that city. The partnership consists of the plaintiffs, Christ and Peter Benninghofen, A. L. S. Campbell and F. A. Keefer. He says the company is incorporated with a capital stock of 10,000 shares, on which $4,500 worth of stock was issued; that, owing to sickness and the difficulty of raising money, the business cannot be successfully operated; that liabilities, now amounting to $1,300, are due, and cannot be met by the corporation. He believes that the assets exceed the liabilities, but at this time of year are unsalable, and cannot be readily converted into money. A receiver was appointed.

THE ice distribution charity, which under the direction of the New York *Herald*, was so conspicuously useful last year, has been revived, the free distribution to the sick poor having begun June 1. At the close of last season's distribution $1,400.69 remained unused, to which, up to June 18, something over $1,000 had been added for the present season's use. Ice is purchased at $2.50 per ton, and distributed to the working poor from fifteen different stations. The mission originated in an investigation suggested by incidents occurring under the eye of one of the newspaper's staff. One of these, the first, was the pitiful appeal of a ragged child for one cent's worth of ice for her sick mother. The one cent was all she could command, and she was refused. The mother was found ill with fever, requiring an ice pack for its alleviation, and unable to retain anything upon her stomach save small fragments of ice. The charity relieved a great amount of misery, and will no doubt become a permanent feature of New York's benevolences, as it has been for a number of years in several southern cities.



[*Written for* ICE AND REFRIGERATION.]

A BUSINESS SUGGESTION.

(EGG) FOOD FOR REFLECTION—THE MOVEMENT OF EGGS FROM FARM TO MARKET—EFFECT OF COLD STORAGE IN CHANGING THE COURSE OF TRADE.

By D. B. BEEMER.

BEFORE the advent of the more or less perfected system of modern cold storage, the egg trade of the country ran in time-worn commercial channels from year to year, with monotonous regularity and sameness. Winter usually brought scarcity of stock and consequent high prices, these last depending on the degree of severity of cold and the depth and spread of snow over the country at large.

Prices of eggs under the stimulus of the proper kind of weather, would sometimes go up to 50 cts. per dozen in car load lots in the big markets of the country, but usually prices ranged through the earlier winter months at 25 to 35 cts. per dozen. With the advent of February and southern eggs, prices would ease off, usually to 20 to 25 cts., and with March and universally heavy receipts, prices would fall in New York to 13 and 14 cts. per dozen, New York virtually "setting the pace" for other markets. Through March, April and May, the heaviest producing months of the year, all the markets of the country would be overflowing with eggs, and only the low prices prevailing kept stock closed out through increased consumption. But such low prices at the great trade centers meant very low prices for the farmer producers, and they would become careless about marketing them, preferring rather to utilize them as cheap provisions for the family table, and by putting them under the setting hens to raise a crop of chickens. By June the effects of this would show up in lighter receipts in the big markets, and prices would advance a few cents per dozen and be maintained on this higher level through July and August, say 16 to 18 cts. With the advent of September and cooler weather, prices would begin to stiffen until by October the range would be 20 to 25 cts. per dozen, while through November, December and January one could gamble on the price, as affected by the weather—the range being from 25 to 35 cts. usually, but in isolated cases going up to 50 cts. per dozen, as before mentioned—all these prices having reference to the New York market more particularly.

Under such circumstances, the farmer producer realized comparatively little for his crop of eggs, owing to the fact that when the output was heavy prices were ruinously low, and when prices were high he had but few to sell. The few cold storage men in the West then carrying eggs in cold storage were able to buy stock at 8 to 10 cts. per dozen through the spring and summer months, and to get from 20 to 30 cts. per dozen for them in the late fall or early winter months. They made big profits right along, but the farmers quite the contrary.

But all that is changed, and a different state of things prevails now. It has always been the practice in the commercial world to keep an observant eye out upon new enterprises and speculations, and when it is demonstrated by any one that there "is money in it" the speculative crowd at once "jumps in," so to speak, takes a lively moneyed interest in it, and proceeds to gather as much "cream" off it as possible at the expense of the man who orginated the business, at the cost, perhaps, of money as well as brains. Usually so many embark in the business that ultimately it becomes "overdone," and the profits which formerly attended its prosecution drop out of sight.

The business of carrying eggs in cold storage has become an example. Artificial cold storage made it possible for a wide belt of egg producing country to carry eggs for winter trade which hitherto for lack of ice, or because of its high price, had been prevented from doing so. These southern sections thus became competitors of the more northern sections when it came to unloading stocks in the fall and winter, while the vast aggregation of stock held in the big refrigerators at the great trade centers, and in the multitude of smaller ones scattered over the country at interior points, made—and makes—eggs almost as plentiful on the market in the fall and early winter as they are in the spring. As spring eggs are known to be the best for storing, all cold storage men and speculators in eggs naturally want to put away such, and they all want them at the same time. Therefore they compete with each other in buying, and bid up prices in the country until they are relatively higher than in the city market. In consequence, shipments to these become light, and commission houses are practically compelled to compete with country buyers by advancing quotations sufficiently to again draw

shipments from the country. Then country buyers, in turn, are obliged to advance prices to keep stock from being shipped past them, or else take the risk of waiting for city markets to become overloaded and prices to recede. The result of this state of things is, that instead of the price of 8 to 10 cts. per dozen which formerly prevailed at interior shipping points throughout the western country, in the spring and summer months, the price is now maintained at about 12½ cts. per dozen.

This difference in price, of course, adds largely to the producers' profits—an immense aggregate sum for the country at large, at the expense of the speculators, whose possible profits are reduced correspondingly. Then, on the other hand, it being a recognized fact that "cold" eggs should be marketed as early in the fall as prices will permit, in order to avoid heavy "loss off," there is, in consequence, wide-spread anxiety on the part of the holders of "cold" stock to market it early. This brings them into competition again, the more timid being satisfied to begin marketing their stock at figures which promise to net them a few cents per dozen profit. They "set the pace" for all others, and so much stock is urged upon the market after October that the bulk of cold storage stock does not usually go above 16 to 18 cts. per dozen. With the stock stored in the first place at 11 to 12½ cts. per dozen, and their selling at 16 to 18 cts. for the great bulk of it, with freight, commission and "loss off" to be yet deducted, it is plain to see that the profit from carrying eggs in cold storage nowadays is whittled down to a very small point indeed.

In short, the business is already overdone, and growing worse from year to year as more operators embark in it. This fact is becoming apparent to many operators, who are already curtailing their operations in this line. The great cold storage houses of Chicago afford the most conspicuous example of this, they having this spring notified their country customers that they would no longer make the advances on stock stored with them that they have been in the habit of doing for several years past. As these advances usually represented the value, or thereabout, of the eggs at the interior points from which they were shipped, the shipper virtually got cost price for his eggs to begin with, and then gambled on a possible rise with the cold storage man's money. This was a powerful lever to use in drawing in the eggs necessary to utilize the cold storage and secure, or realize, cold storage charges; and by the withdrawal of "advances"—whether occasioned by developing uncertainties as to resulting profits from which to reimburse the cold storage men for the amount advanced on eggs, not only, but for freights and cold storage charges, and commission as well, or for the alleged reason given out, to the effect that the banks had refused to put up any more money on the warehouse receipts—the effect must be to discourage shipments of eggs to them and leave the storehouses largely empty.

It is evident that the over-speculation in this line that has prevailed for several years past will have to be curtailed and the fall "output"—so to speak—of eggs relatively diminished, so that the stock in hand shall be light enough to give holders confidence to hold for a paying price and not force sales by competition to unprofitable figures.

But there is but little prospect of this being accomplished by the concerted action requisite to bring about such reform; and we may expect, rather, that for every operator led by his own experience to make a change there will be two new operators entering the field. So we shall probably continue to see the farmers getting good stiff prices for their eggs through the spring months and heavy production, and the consumers being supplied in cold weather at but a small advance over summer prices, both at the expense of the speculator who carries the eggs in cold storage, oftener at a loss than with profit—all *pro bono publico*.

The cold storage of grapes is apparently becoming a parallel case. In earlier times I used to store grapes here at 2½ to 3 cts. per pound and afterward market them at 10 cts. per pound when the market eventually got bare of them later on. But New York and Ohio now ship heavily by car loads all the fall, until near the holidays, and prices seldom get above 3 to 3½ cts. per pound. When the Council Bluffs, Iowa, grape growers shall have completed their large cold storage plant, and are in position to hold their stock at pleasure, and thus be able to put it in competition with that from the "east," we may look for further demoralization in prices.

[*Written for* ICE AND REFRIGERATION.]

APPLES AT THE WORLD'S FAIR.

MORE ABOUT THE COLD STORAGE OF WORLD'S FAIR EXHIBITS OF APPLES—SOME FAILURES, WITH APPARENT REASONS THEREFOR—VEGETABLES—STRAWBERRY SHIPMENTS.

THE fruit exhibits at the World's Fair, Horticultural department, have demonstrated that apples can be satisfactorily carried over from their season well into the following summer without appreciable loss of quantity or quality. Those exhibits have demonstrated that apples in good condition may be made a perpetual article of diet from one year's end to the other; that the product of the orchards, picked in the fall, may be held in cold storage and drawn on for daily consumption through winter, spring and summer, until the next fall's crop is ready for the consumer. The exhibits have demonstrated even more: That while the so-called "good keepers" may be the most satisfactory apples for carrying over, nevertheless the life of the less hardy varieties may similarly be prolonged for many months. It is by no means certain that the good keepers alone, such as the "Spy," "Ben Davis," etc., are profitable for storage as opposed to varieties called poor keepers; for the results show that all kinds alike have kept well, and that no special varieties exhibit markedly better results when drawn from storage.

It must be said right here, however, that apples from the states of Washington, Oregon and Idaho which have not been in cold storage at all, to all appearances have kept quite as well as those which have been in storage. Idaho's fruit, and that of other states also, in a measure, is grown alike on the mountains and in the valleys, with irrigation and without, at altitudes ranging from 600 to 6,000 feet above sea level. Its appearance, size and flavor are all excellent, and it is obvious that the apples are exceptional keepers, showing a length of life after picking, without special treatment, that no fruit of the eastern states or of the Mississippi valley can hope to rival. The writer will not assume to assign a cause

for this phenomenon; the fact is there and the reader may attribute the peculiarity to the climate and its ozone, or to the quality of the soil, or to what-not, as he pleases. It requires no argument, however, to support the fact that the apples of eastern states and of Canada do not keep so perfectly, and that artificial methods must be resorted to to carry them beyond the few weeks which is the ordinary life of an apple after having been picked from the tree.

So far as the World's Fair exhibits are a criterion, there is but one way to keep apples in first-class condition and to have a fruit that when taken out of storage in spring or in midsummer will stand up long enough and well enough to market the fruit in the ordinary course of retail business. That method was described in the June ICE AND REFRIGERATION in the article on "New York Apples," page 473.

As will be remembered, the apples shown by the state of New York, were, when picked, wrapped individually with thin paper, and then packed closely in barrels and kept at a temperature of 33° F. until removed from storage. The New York fruit so treated came out first-class, and has stood up remarkably well—a week to ten days in the hottest weather of June, and as long as thirty days in the milder temperatures of April and May. The theoretical requirement of ventilation is thus set aside in practice, there being no effort to ventilate the fruit; rather, the opposite.

It so happens, fortunately in one sense, unfortunately in another, that the Canadian fruit was carried under different conditions from that from New York, both lots being stored in Chicago, where they were held in different cold storage houses, and for substantially the same length of time. The Canadian apples were picked in October, wrapped in thin paper at the trees and carefully packed in tight barrels, as were the New York lots, and shipped immediately to Chicago. On their arrival at the cold storage house, however, the superintendent in charge there of the storage house removed the fruit from the barrels, and the paper wrappers from the fruit, and having punctured the barrel with auger holes, etc., in order to facilitate ventilation, put back the fruit without wrappers. The temperature of storage called for by the Canadian commissioner in charge of the fruit was 33° F., but the officer in charge of the fruit at the Horticultural building at the Fair says that point was not maintained, since on at least one occasion it was comfortable for him to work in the cold room among the apples in his shirt sleeves, which would hardly be the case at 33° F. The result was, at any rate, that but little more than one-fourth of the fruit stored in October came out in May and June fit to be seen and as little fit for market; in other words, nearly three-fourths of the consignment was a loss. After the opening, in May, of the Hercules Iron Works cold storage house on the Fair grounds, this Canadian fruit was removed to that plant. It was thoroughly sorted and repacked in perfect barrels, each layer of apples being separated from that above it by a sheet of paper. That fruit is generally coming out better than that opened down town. Not only did the fruit as kept down in the city house come out of the storage in very bad condition as a whole, but the apples that were perfect failed to stand up on the exhibiting plates, many of them breaking down in a week, and none of them standing up longer than ten or eleven days; while three weeks was not unusual for New York lots. In the Canada lots the "Spies," "Russets," and one or two other specially hardy varieties "stood the racket" better than the other varieties to a marked degree.

The apples from Illinois and Minnesota orchards were treated in exactly the same way as those from New York, stored in the same house and, indeed, in the same rooms. All came out in good shape, have stood up well for a week to two weeks in the severest weather. "Northern Spies" stook up three weeks from storage, and "Romanites" even longer. Minnesota had some apples on plates under glass in a primitive form of ice box that had been on exhibition since May 1, and were still in good condition June 20.

BERRIES.

For showing berries, Illinois, Minnesota and New Jersey have ice boxes—New Jersey a Wickes butcher's flat refrigerator; Illinois and Minnesota simply sloping rows of shelves, behind and under which ice is placed. No record of temperature is kept, but as the boxes are not insulated, except very roughly, it is not very low in any case, with moist air. Berries are notable as poor keepers under all circumstances, and the record here is not different. In this sort of box Illinois has held raspberries only one day—third from the bushes; strawberries, thirty-six to forty-eight hours, and currants four to five days, twenty-four to thirty-six hours to be added for express transportation.

New Jersey ships her strawberries to Chicago in a refrigerated box. It is a simple contrivance, being a double walled wood box of ½-inch stuff with building paper between the two thicknesses of wood. Its inside measurements are roughly 18×24×36 inches, its longest length being up and down. In the bottom is an iron box to catch the melt, above which are set two trays of berries, then another iron box holding about 50 lbs. of ice. This arrangement keeps the berries (from Newark) comparatively cool (though more or less wet) until their arrival by express at the grounds. One lot the writer saw which were shipped on a Friday, arrived on Monday noon, with about 10 lbs. of ice left in the box, and the berries fresh and solid. The berries are sorted and transferred immediately to the Wickes refrigerator, where some have stood up as long as four days, while others have held out only twenty-four to forty-eight hours.

Oregon showed "Clark's Early" strawberries, from Hood's river, that had come through by express (five days) which were in fair condition eight days from the vines. This is a remarkable berry—very large, unusually red and of high, wild flavor. It is, in fact, only four years from the meadow. It is shipped quite extensively by express to Denver, where its remarkable flavor commands the highest price; but at $300 per car for refrigerators, with railroad haulage charges extra, its introduction to the markets of the northwest and lake region is out of the question.

As remarkable an exhibit, perhaps, as any in the building was the apple show of New South Wales, which colony lately picked her fruit. The apples shown were shipped from Sidney on March 25 by refrigerated steamers *via* London and New York, reaching Chicago May 30, having been sixty-six days out. The fruit on June 20 was in most excellent condition, and only a few had begun to show signs of specking and decay.

VEGETABLES.

Canada, in the northwest corner of Horticultural building, makes a fine show of potatoes, carrots, beets, Swedish turnips, etc., the latter being raised largely for stock feed. These exhibits were all kept from fall until late in April in cold storage, and in the main came out very well. Unfortunately, however, though ordered to be held at about 33° in storage, there appears to be no certainty about the conditions which actually prevailed in cold storage. Some of the produce sent, like the mangleworts, were a total loss through the alleged neglect of the cold storage house. Generally speaking, however, cold storage is agreed by those in charge to have proved a benefit—to the potatoes especially, which now look firm and sound, and as good as a midwinter tuber.

NEW COLD STORAGE PLANTS.

A NUMBER of new cold storage houses, of medium capacity, largely of the ice type, are going up even at this late date of the season, which are noted below:

ARIZONA.

Tempe.—The Hough & More ice factory and creamery are now in operation, making five tons of ice and 150 pounds of butter daily. Several cold storage rooms are also operated in connection with the creamery. The ice works are situated on a plot of land which covers an area of ten acres, which are being tastefully laid out as a park. There is some talk by the proprietors of building a natatorium also.

CALIFORNIA.

Fresno.—D. W. Parkhurst and others have started to organize a cold storage company for storage of fruit, raisins, etc.; capital to be $40,000.

Paso Robles.—A cold storage house has been built here by a Baden firm.

ILLINOIS.

Streator.—A cold storage house, 50×100 feet in size, with three stories and basement, is in course of construction.

MAINE.

Portland.—The authorities are building a cold storage at the Maine general hospital.

Rockland.—The cold storage plant at Tillson's wharf is being rapidly pushed to completion.

MINNESOTA.

Red Wing.—Work has begun on the cold storage house for the state reform school.

NEW YORK.

Lyons.—Geo. W. Knowles will erect a cold storage house, 126×36 feet, three stories high, with metal roof.

OHIO.

Warren.—A stock company has been organized to take over the plant of Young & Chryst. The company now have $75,000, the incorporators being Neal Young, C. C. Chryst, O. K. Grimmesey and R. A. Cobb.

PENNSYLVANIA.

Meadville.—The L. C. Magaw cold storage house is about completed.

Philadelphia.—A brick cold storage house is going up on 3721 Old York road, 24×13⅔ feet, two stories high.

WISCONSIN.

Superior.—Barber Bros. will build a cold storage house on Banks street, between Fourth and Fifth streets, to be 25×30 feet, three stories high. It will cost $15,000.

ALASKA SALMON.

MR. M. J. KINNEY, one of the oldest and most extensive salmon packers at Astoria, Ore., recently made an important statement regarding the Alaska salmon industry. He said: "I consider that Behring sea and Cook's inlet will be the future field for the salmon industry. I think the pack of northwestern Alaska will reach 4,000,000 cases in less than five years. Half of the salmon streams, as near as I can learn, are not even touched. When we have better railroad facilities to Astoria I expect the cold storage and fresh fish business on the lower Columbia and in Alaska will be simply enormous. Alaska is the coming field for the salmon industry, and I fully expect that the production will double inside of five years." Mr. Kinney shows that the pack has increased from 36,000 cases in 1883 to over 480,000 cases in 1892. He says that the stores and gear sent north this year indicate that the Alaska cannery men are preparing for the largest pack on record. He calculates that it will reach 800,000 cases and quotes an estimate by Mr. Morgan, who is well known in the San Francisco trade. Mr. Morgan estimates the coming Alaska pack at 690,000 cases, of which 165,000 cases will be packed in southeast Alaska, and the remainder in northwest Alaska.

[*Written for* ICE AND REFRIGERATION.]

HYGIENIC ICE.

THE DISTILLATION OF WATER FOR THE MANUFACTURE OF PURE ICE —THE CONDITIONS OBTAINING IN THE ICE FACTORY— IMPROVED RESULTS.

BY J. K. KILBOURN, C. E.

"HYGIENIC or Pure Ice from Distilled Water," is an advertising heading so often seen that it leads to the inquiry, first, as to the method of this distillation, and, second, as to the purity of the product.

The usual method of working is to condense the exhaust steam from the power engine, and make up the deficiency by condensing live steam direct from the boilers. To accept this product as pure water, we must assume that the steam is made in a perfectly clean boiler and from filtered water, and that it is possible to eliminate every trace of oil from the exhaust steam.

It is certainly charitable to assume this, but in practical working these conditions are never found. This method of distillation may be, and doubtless is, destructive of all germs, but it does not give a uniform or palatable product.

By another method of distillation, not in general use by ice makers, much better results may be obtained; this is, to use the steam direct from the boiler and the exhaust steam from the engine, to make from filtered water other steam, from which the water for ice making is obtained. This steam is not contaminated by the constantly accumulating filth in the boiler, nor has it been in contact with the oil used in the engine, and consequently, with suitable provision to prevent exposure to the air, water for ice making can be obtained as nearly pure as it is possible to make it.

The cost of this last named method of distillation would, it is believed, compare favorably with the method in general use. There are makers of suitable apparatus for this improved method who will guarantee to give fourteen tons of distilled water with one ton of coal.

The first cost of the apparatus may be something more, but the manipulation is much less, and the quality of the water is superior in every respect to that obtained by the usual methods.

To those who believe that the time is coming, and is not far distant, when artificial ice will supplant natural ice in every household, any information relating to its purity will be of interest, and it is for these persons that this paper is written.

——W. O. Campbell, receiver of the Stone Lake Ice Co., Hamilton, Ohio, has been directed by the court to sell all property of the company at auction.

[*Reprint from* THEORY OF HEAT.]

THE THERMODYNAMIC MODEL.

THE RESEARCHES OF PROF. J. WILLARD GIBBS IN THERMODYNAMICS —RESULTS OF STUDIES LITTLE KNOWN BY AMERICANS— THERMODYNAMIC PROPERTIES OF A SUBSTANCE.

IN a late issue of ICE AND REFRIGERATION we had occasion to refer to the German translation of the thermodynamic researches by Prof. J. Willard Gibbs, of Yale College, which mark so important a step in the progress of this science, and which are so little known among his countrymen. One of the most interesting chapters of Mr. Gibbs' studies relates to an original and exceedingly valuable method of studying the properties, and more especially the thermodynamic properties of a substance by means of a surface and model; and we herewith reprint from J. Clerk Maxwell's work, "Theory of Heat," some further details of this interesting topic, as follows:

According to this method, the volume, entropy and energy of the body in a given state are represented by the three rectangular co-ordinates of a point in the surface, and this point on the surface is said to correspond to the given state of the body. We shall suppose the volume measured toward the east from the meridian plane corresponding to no volume, the entropy measured toward the north from a vertical plane perpendicular to the meridian, whose position is entirely arbitrary, and the energy, measured downward from the horizontal plane of no energy the position of which may be considered as arbitrary, because we cannot measure the whole energy existing in the body.

The section of this surface by a vertical plane perpendicular to the meridian represents the relation between volume and energy when the entropy is constant, that is, when no heat enters or leaves the body.

If the pressure is positive, then the body, by expanding, would do work against external resistance, and its intrinsic energy would diminish. The rate at which the energy diminishes as the volume increases is represented by the tangent of the angle which the curve of section makes with the horizon.

The pressure is therefore represented by the tangent of the angle of slope of the curve of section. The pressure is positive when the curve slopes downward toward the west. When the slope of the curve is toward the east the corresponding pressure is negative.

A tension or negative pressure cannot exist in a gas. It may, however, exist in a liquid, such as mercury. Thus, if a barometer tube is well filled with clean mercury, and then placed in a vertical position, with its closed end uppermost the mercury sometimes does not fall in the tube to the point corresponding to the atmospheric pressure, but remains suspended in the tube, so as to fill it completely.

The pressure in this case is negative in that part of the mercury which is above the level of the ordinary barometic column.

In solid bodies, as we know, tensions of considerable magnitude may exist.

Hence in our thermodynamic model the pressure of the substance is indicated by the tangent of the slope of the curve of constant entropy, and is reckoned positive when the energy diminishes as the volume increases.

The section of the surface by a vertical plane parallel to the meridian is a curve of constant volume. In this curve the temperature is represented by the rate at which the energy increases as the entropy increases, that is to say, by the tangent of the slope of the curve.

Since the temperature, reckoned from absolute zero, is an essentially positive quantity, the curve of constant volume must be such that the entropy and energy always increase together.

To ascertain the pressure and temperature of the substance in a given state, we may draw a tangent plane to a corresponding point of the surface. The normal to this plane through the origin will cut a horizontal plane at unit of distance above the origin at a point whose co-ordinates represent the pressure and temperature, the pressure being represented by the co-ordinate drawn toward the west, and the temperature by the co-ordinate drawn toward the north.

The pressure and temperature are thus represented by the direction of this normal, and if, at any two points of the surface, the directions of the normal are parallel, then in the two states of the substance corresponding to these two points the pressure and temperature must be the same.

If we wish to trace out on a model of the surface a series of lines of equal pressure, we have only to place it in the sunshine and to turn it so that the sun's rays are parallel to the plane of volume and energy, and make an angle with the line of volume whose tangent is proportional to the pressure. Then, if we trace on the surface the boundary of light and shadow, the pressure at all points of this line will be the same.

In like manner, if we place the model so that the sun's rays are parallel to the plane of entropy and energy, the boundary of light and shadow will be a line such that the temperature is the same at every point, and proportional to the tangent of the angle which the sun's rays make with the line of entropy.

In this way we may trace out on the model two series of lines; lines of equal pressure, which Professor Gibbs calls Isopiestics; and lines of equal temperature, or Isothermals.

Besides these we may trace the three systems of plane sections parallel to the co-ordinate planes, the isometrics, or lines of equal volume, the isentropics or lines of equal entropy, which we formerly called, after Rankine, adiabatics, and the isenergics or lines of equal energy.

The network formed by these five systems of lines will form a complete representation of the relations between the five quantities, volume, entropy, energy, pressure and temperature, for all states of the body.

The body itself need not be homogeneous either in chemical nature or in physical state. All that is necessary is that the whole should be at the same pressure and the same temperature.

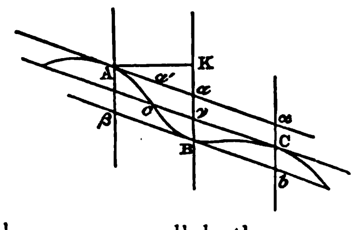
By means of this model Professor Gibbs has solved several important problems relating to the thermodynamic relations between two portions of a substance, in different physical states, but at the same pressure and temperature.

Let a substance be capable of existing in two different states, say liquid and gaseous, at the same temperature and pressure. We wish to determine whether the substance will tend of itself to pass from one of these states to the other.

Let the substance be placed in a cylinder, under a piston, and surrounded by a medium at the given temperature and pressure, the extent of this medium being so great that its pressure and temperature are not sensibly altered by the changes of volume of the working substance, or by the heat which that body gives out or takes in.

The two physical states which are to be compared are represented by two points on the surface of the model; and since the pressure and temperature are the same, the tangent planes at these points are either coincident or parallel.

The surface representing the thermodynamic properties of the surrounding medium must be supposed to be constructed on a scale proportional to the amount of this medium; and as we assume that there is a very great mass of this medium, the scale of the surface will be so great that we may regard the portion of the surface with which we have to do as sensibly plane; and since its pressure and temperature are those of the working substance in the given state, this plane surface is parallel to the tangent plane at the given point of the surface of the model.



Let A B C be three points of the model at which the tangent planes are parallel, the energy being reckoned downward.

Let A a' a be the tangent plane at A, and let us consider it as part of the model representing the external medium, this model being so placed that volume, entropy and energy are reckoned in the opposite directions from those in the model of the working substance.

Now let us suppose the substance to pass from the state A to the state B, passing through the series of states represented by the points on the isothermal line joining the points of equal temperature A and B.

Then since the working substance and the external medium are always at the same temperature, the entropy lost by the one is equal to that gained by the other.

Also the one gains in volume what is lost by the other.

Hence, during the passage of the working substance from the state A to the state B, the state of the external medium is always represented by a point in the tangent plane in the same vertical line as the point representing the state of the working substance.

For the same horizontal motion which represents a gain of volume or entropy of the one substance represents an equal loss of volume or entropy in the other.

Hence, when the state of the working substance is represented by the point B, that of the external medium will be represented by the point a, where the vertical line through B meets the tangent plane through A.

Now the energy is reckoned downward for the working substance and upward for the external medium. Hence, drawing A K horizontal, K B represents the gain in energy of the working substance, and K a the loss of the external medium.

The line B a, or the vertical height of the tangent plane above the point B, represents the gain of energy in the whole system, consisting of the working substance and the external medium, during the passage from the state A to the state B. But the energy of the system can be increased only by doing work on it.

But if the system can of itself pass from one state to another, the work required to produce the corresponding changes of configuration must be drawn from the energy of the system, and the energy must therefore diminish.

The fact, therefore, that in the case before us the energy increases, shows that the passage from the state A to the state B in presence of a medium of constant temperature and pressure, cannot be effected without the expenditure of work by some external agent.

The working substance, therefore, cannot of itself pass from the state A to the state B, if B lies *below* the plane which touches the surface at A.

We have supposed the substance to pass from A to B by a process during which it is always at the same temperature as the external medium. In this case the entropy of the system remains constant.

If, however, the communication of heat between the substances occurs when they are not at the same temperature, the entropy of the system will increase; and if in the figure the gain of entropy of the working substance is represented by the horizontal component of A B, the loss of entropy of the external medium will be represented by a smaller quantity, such as the horizontal component A a'. Hence a' will be to the left of a, and therefore higher. The gain of entropy of the system will therefore be represented by the horizontal part of a a'

Now since temperature is essentially positive, a gain of entropy at a given volume always implies a gain of energy. Hence the gain of energy is greater when there is a gain of entropy than when the entropy remains constant.

There is, therefore, no method by which the change from A to B can be effected without a gain of energy, and this implies the expenditure of work by an external agent.

If, therefore, the tangent plane at A is everywhere above the thermodynamic surface, the condition of the working substance represented by the point A is essentially stable, and the substance cannot of itself pass into any other state while exposed to the same external influences of pressure and temperature.

This will be the case if the surface is convexo-convex upward.

If, on the other hand, the surface, at the point B, is either concave upward in all directions, or concave in one direction and convex in another, it will be possible to draw on the surface a line from the point of contact lying entirely above the tangent plane, and therefore representing a series of states through which the substance can pass of itself.

In this case the point of contact represents a state of the substance which, if physically possible for an instant, is essentially unstable, and cannot be permanent.

There is a third case, however, in which the surface, as at the point C, is convexo-convex, so that a line drawn on the surface from the point of contact must lie below the tangent plane; but the tangent plane, if produced far enough, cuts the surface at C, so that the point A lies above the tangent plane. In this case the sub-

stance cannot pass through any continuous series of states from C to A, because any line drawn on the surface from C to A begins by dipping below the tangent plane. But if a quantity, however small, of the substance in the state A is in physical contact with the rest of the substance in the state C, minute portions will pass at once from the state C to the state A without passing through the intermediate states.

The energy set at liberty by this transformation will accelerate the subsequent rate of transformation, so that the process will be of the nature of an explosion.

Instances of such a process occur when a liquid not in presence of its vapor is heated above its boiling point, and also when a liquid is cooled below its freezing point, or when a solution of a salt, or of a gas, becomes supersaturated.

In the first of these cases the contact of the smallest quantity of vapor will produce an explosive evaporation; in the second, the contact of ice will produce explosive freezing; in the third, a crystal of the salt will produce explosive crystallization; and in the fourth, a bubble of any gas will produce explosive effervescence.

Finally, when the tangent plane touches the surface at two or more points, and is above the surface everywhere else, portions of the substance in states corresponding to the points of contact can exist in presence of each other, and the substance can pass freely from one state to another in either direction.

The state of the whole body when part is in one physical state and part in another is represented by a point in the straight line joining the center of gravity of two masses equal respectively to the masses of the substance in the two states, and placed at the points of the model corresponding to these states.

Hence, in addition to the surface already considered, which we may call the primitive surface, and which represents the properties of the substance when homogeneous, all the points of the line joining the two points of contact of the same tangent plane belong to a secondary surface, which represents the properties of the substance when part is in one state and part in another.

To trace out this secondary surface we may suppose the doubly tangent plane to be made to roll upon the surface, always touching it in two points called the node-couple.

The two points of contact will thus trace out two curves such that a point in the one corresponds to a point in the other. These two curves are called in geometry the *node-couple* curves.

The secondary surface is generated by a line which moves so as always to join corresponding points of contact. It is a developable surface, being the envelope of the rolling tangent plane.

To construct it, spread a film of grease on a sheet of glass and cause the sheet of glass to roll without slipping on the model, always touching it in two points at least.

The grease will be partly transferred from the glass to the model at the points of contact, and there will be traces on the model of the node-couple curves, and on the glass of the corresponding plane curves.

If we now copy on paper the curve traced out on the glass and cut it out, we may bend the paper so that the cut edges shall coincide with the two node-couple curves, and the paper between these curves will form the derived surface representing the state of the body when part is in one physical state and part in another.

There is one position of the tangent plane in which it touches the primitive surface in three points. These points represent the solid, liquid, and gaseous states of the substance when the temperature and the pressure are such that the three states can exist together in equilibrium.

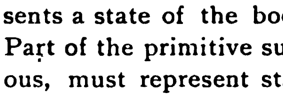
The plane triangle, of which these points are the angles, represents all possible mixtures of these three states. For instance, if there are S grammes in the solid state, L grammes in the liquid state, and V grammes in the state of vapor, this condition of the substance will be represented by a point in the triangle which is the center of gravity of masses S, L and V placed at the corresponding angular points.

From this position of the tangent plane it may roll on the primitive surface in three directions so as in each case to touch it at two points. We thus obtain three sheets of the derived surface, the first connecting the solid and liquid states, the second the liquid and gaseous states, and the third the gaseous and solid states. These three developable surfaces, together with the plane triangle S L V, constitute what Professor Gibbs calls the Surface of Dissipated Energy.

Of the three developable surfaces the first and third, those which connect the solid state with the liquid and gaseous, have been experimentally investigated only to a short distance from the triangle S L V; but the sheet which connects the liquid and gaseous states has been thoroughly explored.

The experiments of Cagniard de la Tour and the numerical determinations of Andrews show that the curves traced out by the two points of contact of the doubly tangent plane unite in a point which represents what Andrews calls the critical state. At this point the two points of contact of the rolling tangent plane coalesce, and if the plane continues to roll on the surface it will touch it at one point only.

If the primitive surface forms a continuous sheet beneath the surface of dissipated energy, it cannot be at all points convexo-convex upward.



For let A D be the line joining two corresponding points of contact of the doubly tangent plane, and let A B C D be the section of the primitive surface by a vertical plane through A D, then it is manifest that the curve A B C D must in some part of its course be concave upward.

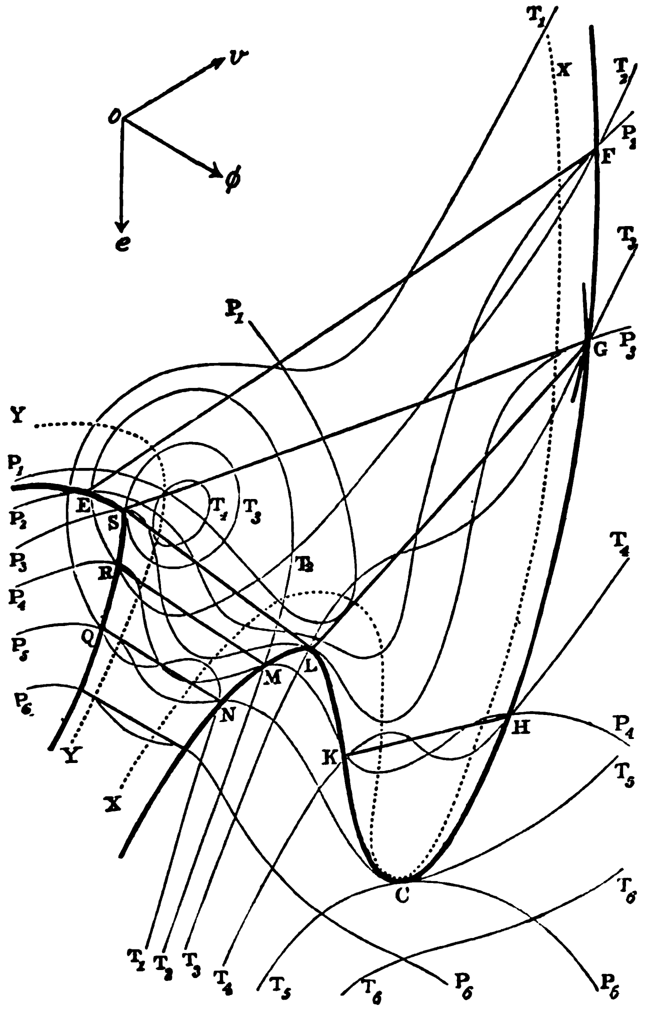
Now a point on the primitive surface at which either of its principal curvatures is concave upward represents a state of the body which is essentially unstable. Part of the primitive surface, therefore, if it is continuous, must represent states of the body essentially unstable. If, therefore, the primitive surface is continuous, there must be a region representing states essentially unstable, because one or both of the principal curvatures is concave upward. This region is bounded by what is called in geometry the *spinode* curve. Beyond this curve the surface is convexo-convex, but the tangent plane still cuts the surface at some more or less distant point till we come to the curve of the node-couple, at which the tangent plane touches the surface at two points. Beyond this the tangent plane lies entirely

above the surface, and the corresponding state of the body is essentially stable.

The region between the spinode curve and the node-couple curve represents states of the body which, though stable when the whole substance is homogeneous, are liable to sudden change if a portion of the same substance in another state is present.

Since every vertical section through two corresponding points of contact must cut the spinode curve at the points of inflexion B and C, the chord A D of the node-couple curve and the chord B C of the spinode curve must coincide at the critical point, so that at this point the spinode curve and the two branches of the node-couple curve coalesce and have a common tangent. This point is called in geometry the *tacnodal* point.

Thermodynamic Surface.



O Origin.
O V Axis of volume.
O φ Axis of entropy.
O e Axis of energy.

$P_1 \ldots P_6$ Isopiestics or lines of equal pressure.

Of these P_1 represents a negative pressure, or, in other words, a tension, such as may exist in solids and in some liquids.

$T_1 \ldots T_6$ Isothermals, or lines of equal temperature.

The curves T_3 and T_4 have branches in the form of closed loops.

F G H C. To the right of this line the substance is gaseous and absolutely stable. To the left of F G it may condense into the solid state, and to the left of G H C it may condense into the liquid state.

C K L M N. Below this line the substance is liquid and absolutely stable. To the right of L K C it may evaporate, to the left of L M N it may solidify.

Q R S E. To the left of this line the substance is solid and absolutely stable. To the right of S R Q it may melt, and above S E may evaporate.

C is the critical point of the liquid and gaseous states.

Below this point there is no discontinuity of states.

C is called in geometry the tacnodal point.

The curves F G, G H C K L, L M N, Q R S and S E are branches of what is called in geometry the node-couple curve.

The curves X C X and Y Y are branches of the spinode curve.

Above this curve the substance is absolutely unstable. Between it and the node-couple curve the substance is stable, but only if homogeneous.

The plane triangle S L G represents that state of uniform pressure and temperature at which the substance can be partly solid, partly liquid and partly gaseous.

The straight lines represent states of uniform pressure and temperature in which two different states are in equilibrium.

S G and E F between solid and gaseous.

G L and K H between liquid and gaseous.

S L, R M and Q N between solid and liquid.

The surface of dissipated energy consists of the plane triangle S L G and the three developable surfaces of which the generating lines are those above mentioned. This surface lies above the primitive thermodynamic surface, and touches it along the node-couple curve.

IMPURE ICE QUESTION.

OF all places in the world, New Orleans would seem to be the last where the "impure ice" craze could find lodgment; but about a month ago it broke out there with all the fury of an epidemic, and the theory that "chemicals were used in the water by some manufacturers to reduce the cost" was gravely discussed by the learned reportorial staff of certain daily papers! A filter slightly out of order was no doubt at the bottom of the trouble, while now and then a little rust may have appeared in the "core." The excitement has subsided, and the "daily bulletins" have been discontinued.

A REPORTER at Rochester, N. Y., found a mare's nest there recently, and in the absence of other sensation for the day worked up a "very good thing," which reminds the average newspaper man of Mark Twain's early reportorial experiences in Virginia City writing up the "hay market" (of one lone load). The board of health, however, seemed to preserve their equilibrium under the pressure, and allayed any nervousness by assuring the florid and imaginative scribe that when they found any impure ice, the ordinance would enable them to deal with it.

THE city council's committee at Boston reported, May 26, that no action was necessary on the order in regard to an examination of ice and the source of supply of the same, by the inspector of milk and vinegar, as the state board of health has recently made two exhaustive examinations of the ice sources and supply. And the crank, like the villain in the play, is "crushed again."

ICE & REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION, THE TEXAS ICE MANUFACTURERS ASSOCIATION AND THE FLORIDA ICE MANUFACTURERS ASSOCIATION.

∵ JULY, 1893 ∵

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IN ADVANCE, POSTAGE PREPAID.

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H. S. RICH   S. P. FOWLER   J. F. NICKERSON   JNO. GLENN COLLINS

H. S. RICH & CO.
PUBLISHERS,

177 La Salle St., Cor. Monroe, CHICAGO.   206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

INDEX TO ADVERTISERS.

A MUDDLED PHILOSOPHER.

THE *American Dairyman*, of New York city, in a recent issue, devotes some five columns of space to an attack on manufactured ice, which, as a specimen of "special pleading," is about as near the climax of "biggod nonsense," as Mr. Sparkler used to say, as it is possible for the average mind out of an asylum to attain to. The befuddled gentleman, in the first instance, insists that ice as gathered from a running stream, "like our beautiful Hudson," is "shown in its most perfect state"—"in its purest condition." In which view he takes direct issue with all sanitarians, who insist that ice is not always thus "shown in its purest condition," from the fact that the Hudson is, in certain portions, at least, contaminated with sewage. The reasoning of the befuddled philosopher as to natural ice is carried out on the same line indefinitely; and he has the assurance even to quote ICE AND REFRIGERATION to substantiate his claim that natural ice is pure always and under all circumstances—a quotation made in the true Dogberry style, in that he ignores all the incidental remarks made about the contamination of rivers by sewage. Water that is pure enough to drink is, of course, pure enough to use as ice; but, on the contrary, water that is unfit to use as water is unfit to use as ice—a view, or fact, that our muddled special pleader is at some pains to suppress.

But it is when he undertakes to prove that manufactured ice, as now made for the trade, is always and necessarily impure, that the gentleman really turns himself loose. He says:

> Repulsive odors seem inseparable from its melting state. The unmistakable stench of the refrigerator where it is kept is an ever present invitation to disease. If there were no other objection to it, this should be an all-sufficient one for an avoidance of its use. In melting it releases the chemicals that caused its solidity, and these are actively detrimental to health. With the use of natural ice a more pleasing story is easily told. In its formation nature's chemistry employs elements that are essential to organic life, and these, when reduced to their elementary state, are harmless.

From all of which it must appear to every intelligent reader that the gentleman is talking very vigorously "through his hat." He clearly has no idea of how ice is made. To talk of odors from the melting ice is an absurdity. Undoubtedly a refrigerator that is not systematically cleaned will stink, but the question arises, Is it the melting ice or the contents of the food receptacle that causes the odors? In 99 out of 100 cases it is undoubtedly the latter, as every good housewife knows. As to the idea that the melting of ice "releases the chemical that caused its solidity," that of course is too ridiculous for serious consideration.

The special pleas against manufactured ice, however, rest on three points: (1) Water is taken by one New York

factory from the river between two sewers. [This undoubtedly is a reference to "cooling water," if the fact be true. But it is strange that he does not recollect that some of the natural ice, that is, "ice in its purest condition," may be frozen sewage.] (2) That pure distilled water is too expensive for ice making; and (3) that the air of the factory contaminates this water even after distillation; and he quotes in the same *ex-parte* manner Dr. Prudden when the latter says:

It is extremely difficult to prepare germ-free water on a large scale, and almost impossible to keep it so if once prepared, because every exposure to the air or contact with utensils in common use brings to it—and often large numbers of—germs which can live and grow in water.

The "cussedness" of the gentleman's system of quotation of authorities is amply illustrated right here; for he has systematically and "with malice aforethought," suppressed the vital point, that is, the concluding sentence of the paragraph quoted, to wit: "But these small numbers of common bacteria are not of the slightest importance to the salubrity of the water." Prudden in fact says:

So far as the salubrity of the natural ice is concerned, we may rest assured that as regards bacteria, one is just as wholesome as the other, provided the water is pure. If the water is impure from sewage or other unwholesome thing, then the natural ice is never fit for domestic use. If water is impure, the processes of artificial ice making, if carefully performed, are capable of furnishing, even from it, a product which is harmless and wholesome, whether it be absolutely germ-free or not; for absolute freedom from germs—if these are not disease-producing germs—is neither necessary nor especially desirable. It is not bacteria, but disease-producing bacteria, which make of practical significance the invisible flora of either water or ice.

New York ice is made from distilled Croton water, not river water, its reduction to steam killing by that process every disease-producing germ. If in the subsequent processes it should take up bacterial life, these are harmless. That is the sum and substance of all recognized authority.

It is manifestly impossible to wade through five columns of this "rubbish" of the *American Dairyman*. The entire article is the product of an ignorant special pleader, and sounds as though written "for a purpose." Its defiance of logic and of authority and its deliberate falsification of the truth as uttered even by the authorities quoted, by a skillful suppression of the pith of the quotations, is not simply unfair, but disreputable, for it is not far removed from downright lying.

Our readers who have sent us from various places this product of a diseased imagination, should lose no sléep on its account. Its mis-statements correct themselves; and can deceive no intelligent reader. The author's capacity for sleek deception may also be exposed and his plea annihilated by reference to the Prudden article itself, from which he (mis)quotes so often, which will be found in *Harper's Magazine* for August, 1892. It may be said in passing, that Prudden comes to a very different conclusion as to natural and artificial ice; and that a reference to his article will disclose the fact that he is, for New York use, a firm friend of manufactured ice, though by no means an enemy of natural ice that is frozen on pure streams or ponds. And after presenting the whole case, in all its aspects, in the most thorough and complete manner, discussing every conceivable point and looking at every side of the question, he says:

In this condition of affairs it does not seem clear to the writer why any New York householder should long hesitate between the use of artificial ice made from the Croton water and the abundant chances for evil which lurk in the sewage ice of Hudson river. * * * My readers will, I am sure, deplore with me the necessity for weaving the shadow of disease into so dainty a theme as ice *and its manufacture.*

DISTILLED WATER.

THE desirability of long life, *i. e.*, life extending far beyond the Scriptural three-score and ten or four-score years, is something about which speculative minds will differ. The young, to whom mere existence is a pleasure, no doubt will agree that long life would be the most desirable of earthly gifts; for while most young people really live as though they were immortal, they may admit that they are mortal, but should the reality in fact impress them, they equally dread the "long time a man remains dead." As later years come, with their cares and burdens and troubles, physical and financial, the desirability of length of years becomes a matter of doubt; but even this doubt might disappear before the presence of perpetual good health, or that of one's younger years.

We cannot defy death, says Wm. Kinnear, in a remarkable article in the June *North American Review;* but the possibility of extending the average of human life beyond a century, or even to two centuries, with average good health, may be no more a scientific dream than was the thought fifty years ago of crossing the Atlantic by steam within a week's time. The chief characteristics of old age, says our essayist, are deposits of earthy matter of a gelatinous and fibrous character in the system—a gradual ossification, producing imperfect circulation of the blood, impaired nutrition, thereby impairing the recuperative power of the body, which if always perfect in all stages of life would render death a matter of accident only. In age the wastes are greater than the repair, hence there is a gradual decay until the climax is reached and death claims its own. The problem, then, for solution is how to check these osseous and cartilaginous enemies of life.

Oxygen and the oxidation resultant by breathing the air is one potent factor of the decay of life. The chemical changes effected by its presence are, indeed, necessary to human life, but in those processes the oxidation is, as we may say, excessive. The accumulations of decompositions effected by oxidation are greater than the eliminations, and these accumulations increasing with age produce the term "feeling one's age." To prolong life, therefore, it is only necessary to prevent the bodily functions from becoming clogged, avoiding in eating those foods which contain salts of calcareous nature, such as cereals, bread, and such meats as beef and old mutton. Hence a diet of fruit principally is best for people advancing in age, as are also fish, poultry and young mutton and veal. Only moderate eating should be indulged in, with frequent bathing and abundant exercise. He concludes by saying:

Excessive action of atmospheric oxygen must be counteracted. Ossific matter deposited in the body must be dissolved as far as practicable. To produce this desired effect distilled wâter and diluted phosphoric acid are, perhaps, the most efficacious and the least harmless. Their combined chemical action retards old age.

The powerful solvent properties of distilled water are well known. As carbonate of lime exists in nearly all drinking water, the careful distillation eliminates this harmful element. As a beverage distilled water is rapidly absorbed into the blood; it

keeps soluble those salts already in the blood, and facilitates their excretion, thus preventing their undue deposit. The daily use of distilled water is, after middle life, one of the most important ·ans of preventing secretions and the derangement of to diluted phosphoric acid, it is one of the most pow- nces known to science for shielding the human sys- he inconveniences of old age. Daily use of it mixed :d water helps to retard the approach of senility. By for oxygen the fibrinous and gelatinous deposits pre- .ded to are checked and their expulsion from the sys- ed. Waste of the tissues is believed to be prevent- the use of hypophosphites.

to sum up, the most rational modes of keeping physi- r deterioration at bay, and thus retarding the ap- ld age, are avoiding all foods rich in the earth salts, fruit, especially juicy, uncooked apples, and by tak- o or three tumblerfuls of distilled water with about n drops of diluted phosphoric acid in each glassful.

is not unmindful that there is some trouble venience in all this. As in one of Mark Twain's ; Frog" stories, his hero replied to the tem- itator,—"True, if I stop smoking and drink- iewing tobacco, I might prolong my miserable a few years, but I wouldn't have any fun!" so ector may say: "I would not take all this d daily trouble to live 200 years—better a short merry one." One can only answer, Take your

THE COLOR OF ICE.

: are those who claim that the light color of ice as compared with river ice is owing to air bottom of the pond coming up against the ice ng in, as the ice is formed; and the reason they ie clear ice, in rivers, is that the air is carried m by the current, says G. H. M. Barrett, of ...port, Me.

If these propositions were correct, ice in ponds would be the same color every year, but this year, 1893, ice cut from ponds up to January 25 was as blue and clear as any river ice ever cut. The true solution of the cause of light color of pond ice is, difference in temperature. Ponds in which ice is cut for shipment are near the coast and subject to the warming influence of the sea, while rivers at the point where ice is cut are more inland, making a difference of at least ten degrees in temperature. The way the color is produced is this: Ice freezes and then a thaw comes on, opening the ice and letting in the air; the next cold wave freezes the top of the ice, confines the air and as the cold increases drives the imprisoned air down deeper, forming a streak of air bubbles through the ice parallel with the surface; this process is repeated again and again until the upper half of the cake becomes lighter colored.

This color is nothing but air, as any one can see by dropping a piece of light colored ice into a dish of water, as the color will then disappear, showing that there is no opaque substance in the ice.

SKATING RINK.

THE Hercules Iron Works has had Architect Franklin P. Burnham, of Chicago, prepare plans and specifications for the creation of a skating rink in top (fifth) story of the cold storage plant at the World's Fair. The space of 50×130 feet will first be covered with P. & B. insulating paper, then with sheet lead, upon which the brine circulating coils will be laid. Over the pipes will lie enough water to cover the pipes when frozen and form the icy surface for skating, while around this sheet of ice a broad promenade will be built for visitors. The floor will be lighted by 2,000 incandescent electric lights. Elevators will carry visitors and skaters to the skating floor, where they can enjoy the novelty of skating on real ice on the hottest of days, in a temperature delightfully refreshing. Since the North Pole Co.'s rink, described in this journal some months ago, has fallen through, the curious who have been disappointed by that fact will here find compensation in seeing that practical novelty in full operation on lines contemplated by the North Pole Co. It will be ready for skating early in July.

THE ice railway by Messrs. De La Vergne and T. L. Rankin, in the Midway Plaisance, is now in actual operation and running full with pleasure seekers. The novelty affords a delightful sensation in itself, as every tobogganist may imagine, and is especially "taking" from the fact that the sleds fly down the long slide on real ice and snow. It is sure to be a grand success during the remaining four months of the Fair.

ICY ITEMS.

——Coey & Co., Keokuk, Iowa, have resumed summer packing of hogs.

——The Fremont Brewing Co. will put up a beer cooler at Hooper, Neb.

——O. Peterson has succeeded Mr. Sorensen, in the ice business at Austin, Ill.

——The Great Falls Ice Co. began shipping from the Pittston houses about the middle of June.

——The Norwood Ice Co., Northampton, Mass., has been purchased by Wm. Grant, of Newton.

——B. Frank Wild has been elected president of the Winkley & Maddox Ice Co., Somerville, Mass.

——H. F. Reed, of Castleton, has purchased the Ellis ice house at Fair Haven, Vt., and is retailing ice at 50c. per cwt.

——The Reilly Coal, Wood and Ice Co. has been incorporated at St. Louis, by James Robert and Frank Reilly; capital, $3,000.

——The Lebanon (Pa.) Brewing Co. has finished the work of putting in a refrigerating machine made by Geo. F. Ott, Philadelphia.

——The DeArmond Bros., Linwood, Ohio, have gone into the ice business, to supply Mt. Lookout and Linwood on alternate days.

——Chas. S. Pierce has sold his ice business at Somerset, Mass., to C. H. Smith, of Dighton, where he has been in business for some ten years.

——C. D. Morrison, of the Moundsville, W. Va., Mineral Wool Co., is at work organizing the Glacier Refrigerator Co., of that place, with $50,000 capital.

——G. Fullman, Williamsport, Pa., has sold his ice and coal business to John M. Lammade, of Bay City, Mich., and John F. Hedden, of the P. & R. railroad. Mr. Hedden will take charge on July 1.

——The McNabb Ice Co., Salem, Ohio, are making twenty tons of ice daily, and will open agencies in neighboring towns and villages. The "grand opening" of the works took place on June 16 and 17, when refreshments were served to their guests.

——Capt. B. de Morainville, superintendent of construction for Armour & Co., Chicago, will erect at Milwaukee a cold storage warehouse, 110×113×80 feet to Second street, near the present quarters of Swift Bros. The building will be three stories high, built of brick and stone with terra cotta trimmings. The structure will cost $40,000, and will be completed by August 15.

——A letter from the United States consul in Mexico City says that the Mexican government will probably withdraw or modify the order recently proclaimed forbidding the importation of beef, excepting on the hoof. Minister Gray and Consul Crittendon recently held a conference with President Diaz and his cabinet on the subject, and received assurances that the matter would be carefully considered.

——A new ice company, with capital of $7,000, has been organized at Quoque, L. I., by Wm. H. Sweesy, Erastus F. Post, Silas E. Jessup, Joseph P. Howell and Wm. H. Camerden. The directors are Wm. H. Sweesy, Erastus Post, Silas E. Jessup, Wm. H. Camerden and Henry Gardiner. President, Silas Jessup; vice-president, Henry Gardiner; secretary and treasurer, Erastus F. Post. The property bought of Wm. H. Sweesy, of Riverhead, consists of two ice houses, three acres of land, a cottage and right of pond for cutting ice; consideration, some $4,000.

TRADE CORRESPONDENCE.

[The publishers of ICE AND REFRIGERATION do not hold themselves responsible for the opinions expressed by correspondents on any topic; but these columns are at all times open for the discussion of subjects of interest to the trade, and such correspondence is at all times welcomed. Our readers are cordially invited to contribute to this department by giving their views on questions propounded, or by suggesting original topics for trade discussion, or notes on the condition of trade in their section of the country. Anonymous letters will receive no attention whatever.—ED.]

FROM THE WEST INDIES.

MONTEGO BAY, JAMAICA, W. I., May 22, 1893.

To the Editor: American machinery of all kinds is fast superseding English and Scotch makes in this colony, and in the way of ice machines the old country "isn't in it." The ice machines in the island now consist of one 5-ton "Boyle," one 10-ton "Boyle" and one 20-ton "consolidated," in Kingston; one 5-ton Weisel & Vilter, in Montego Bay, and one 2-ton machine in Savanna la Mar, which has been abandoned and will be replaced by a 5-ton Weisel & Vilter machine this year.

An article on the ice machine "expert," which appeared in your paper some time ago, leaves something still to be said, for this worthy sea layer is the dread of the salesman and erecting engineer in foreign countries. He works somewhat in this way: A set of specifications is sent by an intending purchaser to his commission merchant in New York to be experted. He hunts up the "expert," who in turn hunts up some ice machine builder's catalogue, or interviews the foreman in some brewery, and then proceeds to pull the specifications of some old established builder of ice machinery all to pieces in order to build an excuse to collect a fee with the pieces.

An instance which might interest readers of ICE AND REFRIGERATION is where an expansion coil was recommended in the water jacket of a $7\frac{1}{2}\times 10$ compressor to prevent cylinder heating.

I would like to hear from some of the writers in ICE AND REFRIGERATION (who, by the way, would do the trade a good turn by making themselves known to New York commission houses) what the theoretical gain or loss would be of such a coil to reduce the temperature of water in the jacket, leaving out of the calculation any loss that might take place from the difficulty in manipulating an expansion valve for such a small coil.

W. J. FRANCKE.

NEW CORPORATIONS.

THE following new companies have been licensed to incorporate during the past month. Where further information concerning them is known by ICE AND REFRIGERATION, notice is made in the regular departments:

ICE COMPANIES.

——Choctaw Ice Co., Denison, Tex.; $50,000.
——Crystal Ice Co., Harrisburg, Pa.; $100,000.
——Middlesex Ice Co., Melrose, Mass.; $100,000.
——Quoque Ice Co., Southampton, N. Y.; $7,000.
——Crystal Ice Co., Pittsburgh and Allegheny; $15,000.

CREAMERIES.

——Keystone Butter Co., Cincinnati; $20,000.
——Nora Creamery Co., Manchester, Ill.; $6,000.
——Eudora Creamery Co., Eudora, Kan.; $20,000.
——Stanton Creamery Co., Stanton, Iowa; $20,000.
——St. Mary's Creamery Co., Benzinger, Pa.; $5,000.
——Plymouth Creamery Co., Plymouth, N. H.; $3,000.
——Visalia Creamery Association, Visalia, Cal.; $5,000.
——Co-operative Creamery Co., White City, Kan.; $6,000.
——Galien Creamery Co., Limited, Galien, Mich.; $5,000.

MISCELLANEOUS CORPORATIONS.

——Armour Packing Co., Denver; $7,500,000.
——Fowler Packing Co., Kansas City; $700,000.
——San Jose Meat Co., San Jose, Cal.; $50,000.
——Garden City Meat Co., San Jose, Cal.; $50,000.
——Western Produce Packing Co., Chicago; $500,000.
——Provincetown Cold Storage Co., Provincetown, Mass.; $15,000.
——North Shore and Knappton Packing Co., San Francisco; $100,000.
——International Fruit Dealers' Despatch Co., Chicago; $500,000.
——International Cooling Co., New York; $5,000,000; to manufacture refrigerating and ice plants.

THE CLINK OF THE ICE.

Notably fond of music, I dote on a sweeter tone
Than ever the harp has uttered, or ever the lute has known.
When I wake at five in the morning with a feeling in my head
Suggestive of mild excesses before I retired to bed—
When a small but fierce volcano vexes my sore inside,
And my throat and mouth are furred with a fur that seemeth a buffalo hide,
How gracious those dews of solace that over my senses fall
At the clink of the ice in the pitcher the boy brings up the hall!

Oh! is it the gaudy ballet with features I cannot name,
That kindles in virile bosoms that slow but devouring flame?
Or is it the midnight supper eaten before we retire,
That presently by combustion setteth us all afire?
Or is it the cheery magnum?—nay, I'll not chide the cup
That makes the meekest mortal anxious to whoop things up.
Yet, what the cause, relief comes when we call,
Relief with that rapturous clinkety-clink, that clinketh alike for all.

I've dreamt of the fiery furnace that was one vast bulk of flame,
And that I was Abed-nego, a-wallowing in that same.
And I've dreamt I was a crater possessed of a mad desire
To vomit molten lava and to snort big gobs of fire.
I've dreamt I was Roman candles and rockets that fizzled and screamed—
In short, I have dreamt the cussedest dreams that ever a mortal dreamed;
But all the red-hot fancies were scattered quicker than wink
When the spirit within the pitcher went tapping its clinkety-clink.

Boy, why so slow in coming with that gracious saving cup?
Oh! haste thee to the succor of the man who is burning up.
See how the ice bobs up and down as if it wildly strove
To reach its grace to the wretch who feels like a red-hot kitchen stove.
The piteous clinks it clinks methinks should thrill you through and through—
An erring soul is wanting drink, and he wants it p. d. q.
And lo! the honest pitcher, too, feels in so dire a fret,
That its pallid form is presently bedewed with a chilly sweat.

May blessings be showered upon the man who first devised this drink,
That happens along at 5 A. M. with its rapturous clinkety-clink.
I never have felt the cooling flood go sizzling down my throat
But what I vowed to hymn a hymn to that clinkety-clink devote.
So now in the prime of my manhood, I polish this lyric gem,
For the uses of all good fellows who are thirsty at 5 A. M.—
But 'specially for those fellows who have the pleasing thrall
Of the clink of the ice in the pitcher the boy brings up the hall.

—*Eugene Field.*

A STUDENT OF MANKIND.

"Yes," said the man with the yellow diamonds, "there is a heap more chance for graft in the ice business than there is in selling coal."

"Why?" asked the man with the straw colored vest.

"'Cause the ice business comes in hot weather, when the people are too lazy to kick about the prices you stick them for."

THE KNOWING KID.

TEACHER—"When water becomes ice, what is the great change that takes place?"

PUPIL—"The change in price."—*Detroit Tribune.*

——W. A. Geise and Wm. Nichols have gone into the ice business at Champaign, Ill.

——The McNabb Ice Co., Salem, Ohio, was opened to the public June 20, when a large number of citizens were present. Hire's root beer and a special grade of iced tea were furnished visitors free, and the opening was a grand success. The company then sent out their wagons giving away ice from house to house in 30-pound blocks every other day for a week to permit the public to inspect and test the ice, after which their solicitor was sent out, and his success in obtaining permanent customers is the best evidence that the plan was a success. The plant has a daily capacity of twenty-five tons, all of which will be sold. Several neighboring towns have contracted for ice, while the surplus product has been sold for the season to Allegheny dealers.

[*Written for* ICE AND REFRIGERATION.]

THE WORLD'S FAIR.

ABSORPTION ICE MAKING PLANT ON THE WORLD'S FAIR GROUNDS —DESCRIPTION OF THE PAVILION—SOME WORLD'S FAIR EXHIBITS.

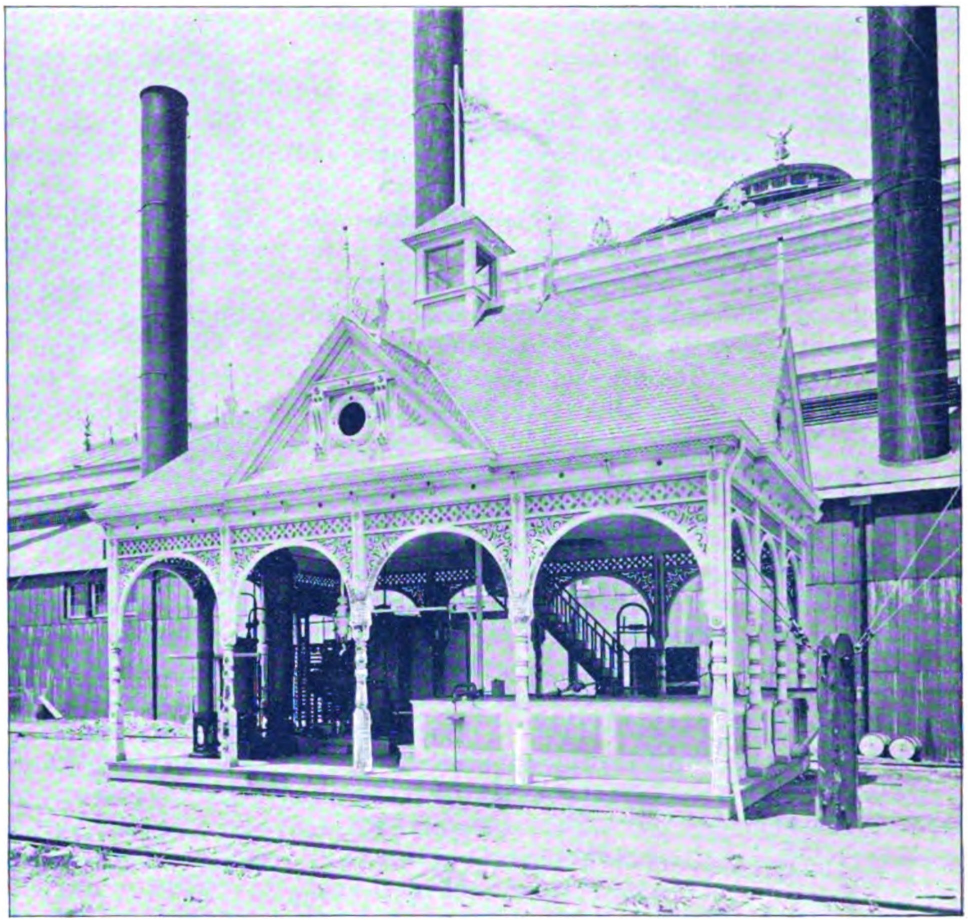
WE have on prior occasions illustrated and described the exhibits of ice making and refrigerating machinery made at the World's Fair by the Hercules Iron Works (at the cold storage house), the Fred. W. Wolf Co. (Waukesha Mineral Springs Co.'s cooling plant) and the De La Vergne Refrigerating Machine Co. (ice railway on Midway Plaisance), all of which are now in full operation, and may be seen at any time by our readers and all others interested.

There has also been completed, since our last issue, an ice making plant on the absorption system, by Messrs. Henderson, Thoens & Gerdes, of New Orleans, La., which will interest the trade. Their pavilion is located in the rear of the boiler house of Machinery hall, somewhat east of the center line of that plant. The pavilion is a simple structure in the Queen Anne style, without walls of any kind, the ice tank (16×16 feet, containing 100 200-lb. ice cans) producing eight tons of ice daily, and all of the machinery being located in the open air, though covered by roof, as will be seen by the picture herewith.

The machinery consists of retort, exchanger, heater, ammonia pump, cooler, condenser, absorber and rectifier, of which the absorber, cooler and water cooler are in the open air, while the condenser and rectifier are enclosed in a tank. The plant is complete with all necessary gauges, extra heavy pipes and fittings and endless coils in ice tank.

This plant, which is in actual daily operation, making ice from condensed water and also from common lake water, is a new type of absorption machine recently patented by the manufacturers. Its special features are the following: (1) The liquefied ammonia is anhydrous, no water going over into the condenser and the refrigerator. This is effected by the use of two condensers. The gas coming from the retort passes through the first condenser, which is kept at a temperature below 212°, but above a temperature at which the gas would liquefy. Therefore any steam contained in the gas will condense in the first condenser and fall as water into a receiver or trap, whence it is discharged through a cooling coil into the receiver of the absorber. The ammonia gas, then free from steam, passes from the receiver or trap, into the second condenser, where it is finally liquefied. (2) Low pressure in the absorber and refrigerator which is obtained by the new form of absorber; and (3) the use of the exhaust steam to heat the already partly heated rich liquor coming out of the exchanger on its way to the retort. The machine, in fact, works almost entirely from the exhaust steam from the ammonia pump, the difference in temperature of the rich liquor entering the retort and the poor liquor leaving the retort being only 10°, which are supplied by direct steam, while the balance of the work is done by the exhaust steam. The cooling water for this plant has been found to be only twenty-one gallons per minute.

The machine is very compact, the whole pavilion and contents occupying but very little ground space; and as the only absorption machine on the ground it will be found to be of special interest to all our readers who visit the Fair.



WORLD'S FAIR—ICE MAKING PAVILION OF HENDERSON, THOENS & GERDES.

SOME OTHER EXHIBITS.

The Frick Co., of Waynesboro, Pa., have in Machinery hall (Col. O, 30) an 11-ton "Eclipse" refrigerating machine on exhibition. The exhibit is not under power, but the machine is an exact duplicate of two that are in operation in the Hotel Savoy, New York city.

Just to the north of Frick is a 150-ton De La Vergne double-acting refrigerating machine; and in the model of the Bartholomay brewery in Agricultural hall (west gallery) is a miniature model of the same company's machines working in that plant.

An interesting feature of the Krupp gun exhibit, located southeast of the Agricultural building, is the refrigeration of the building by brine circulation, a carbonic acid gas machine being employed as the refrigerator. In the foundry at Essen, the conditions of manufacture require cooling of the air of the plant, and the system there employed is reproduced on a smaller scale at the exhibit at Chicago. The Essen plan is the use of brine circulating coils, which are massed as a fountain,

and when the pipes have become frosted a jet of water is turned on, and the "fountain" becomes a frozen cascade. The pavilion at the Fair is provided with two such fountains, one in the southwest and the other in the northeast corner of the large room. The basins are fourteen feet in diameter and elevated six feet above the floor. The coil rises twelve feet high from the center of the basin, and the water jet issues from the top of it. The fountain in the southwest corner of the room was started in an imperfect manner on June 27. The jet of water was not playing, but a man was spraying the coil with water from a hose, and it was all frozen over a snowy white. The reduction of temperature noted was very appreciable to visitors in its vicinity by its refreshing coolness. Both fountains were expected to be in complete operation on June 29.

The Deane Steam Pump Co., of Holyoke, Mass., have seventeen of their machines on exhibition at the World's Fair, and all but one are in actual operation on work in the several departments. One of the machines, forming a part of the United States patent office exhibit, is a section of their boiler feed pump. It shows the construction of the interior of the pump and the working of the Deane patent valve motion. They have two duplex pumps, each with 7½-inch steam cylinders, 4½-inch water plungers and 10-inch stroke in the main boiler room furnishing feed waters for boilers. In the Machinery building there are two Deane air and circulating pumps, with 16-inch steam cylinders, 16-inch vacuum cylinders and 16-inch water cylinder and 18-inch stroke, each in connection with a Wainwright surface condenser, on a 21½ and 37×22 Westinghouse compound engine. In the Western Dummy Railroad Co.'s power house there is a Deane patent independent condensing apparatus on a 13 and 23×22 McIntosh & Seymour compound engine. The condensing apparatus consists of a vacuum pump with 8-inch steam cylinder, 12-inch vacuum cylinder and 12-inch stroke with a jet condenser. All of the pumping machinery in the ice and cold storage building on the Fair grounds is furnished by the Deane Steam Pump Co. There are seven duplex pumps, pumping brine and water, of the following dimensions: Four with 6-inch steam cylinders, 5¾-inch water plungers and 6-inch stroke; two with 10-inch steam cylinders, 10¼-inch water plungers and 10-inch stroke; one with 9-inch steam cylinders, 8½-inch water plungers and 10-inch stroke. There are two 10—6—10 duplex and two 7½—4—10 duplex double plunger pumps feeding boilers. The double plunger pumps are furnishing water to boilers which carry a steam pressure of 300 pounds. The headquarters of the Deane company are in the ice building, which is near the main entrance on the right-hand side. Mr. Charles Howard is manager of the Chicago office and warerooms of the Deane Steam Pump Co., at 226 and 228 Lake street, and Mr. F. S. Scott is the engineer in charge of the pumps of the company on the Fair grounds.

A fine exhibit in the line of specialties in steam goods is that of the Penberthy Injector Co., of Detroit, Mich. They are located in Sec. 25, Machinery hall, where their exhibit is housed under a handsome pagoda decorated in delicate shades of blue and terra cotta. A railing made of Penberthy injectors, and safety crank pin oilers, arranged in unique design encloses their space, and within this they show the visitor their injector in actual operation. They also have a complete line of sizes on pedestals for inspection, and exhibit full lines of all their other specialties. The exhibit is in charge of their traveling salesman, Mr. W. O. Lee, and their manager, Mr. S. Olin Johnson, who will be pleased to meet all steam users.

The Chapman Valve Manufacturing Co. (of Indian Orchard and Boston, Mass.) have, at Col. K, Sec. 28, a very comprehensive showing of valves and gates for water, steam, ammonia, gas, etc., in brass and iron. The company make a specialty of brewers' and refrigerating machine work.

The Reliance Gauge Co., Cleveland, have practically two exhibits, having equipped twenty-one boilers in the boiler house with their appliances, where they may be seen in operation, while in the Electrical building the exhibit there covers a space twenty-three feet six inches long by fourteen feet deep, on one of the main aisles of the second floor overlooking the floor below. The exhibit consists of regular stock, and includes all sizes of Reliance columns, finished brass and nickel-plated, while the variety, arrangement and furnishings of the exhibit are such as to make it exceedingly attractive. It is in charge of officers of the company and their traveling salesmen, and visitors are invited to stop there.

The Standard Paint Co.'s (New York, etc.) exhibit is buried, so to speak, being the insulating paper used in the cold storage house and in the Fred W. Wolf's Hygeia cooling plant, as well as in the 140 miles of Hygeia pipe line carrying the water from the springs at Waukesha to and through the Fair grounds, which are coated with P. & B. pipe coating compound.

The Crosby Steam Gauge Co., Boston, have in Machinery hall (Col. K, Sec. 25) a very complete line of gauges, gates and valves in brass and iron, with hose and hose couplings. The whole exhibit is most beautifully designed and very effective. It is in constant charge of an attendant to give information.

In the boiler plant Messrs. Abendroth & Root, New York, have several of the "Improved Root" boilers in operation, which are always accessible to visitors. They are at the east end of the battery. They are of large size, and their performance is systematically recorded, while information is accessible to those interested.

THE ice box is at best a poor contrivance when compared with a refrigerator, being without circulation of air. It has, however, its sphere of usefulness, not alone as a substitute for a refrigerator, but as a receptacle for surplus ice—say the double delivery of a Saturday, for Sunday use in small refrigerators. The ice box is easily made: Take a box, say 36×24×18 inches, made from yellow pine or poplar lumber. Bore from three to five half-inch holes in the bottom of the same for the escape of water from the ice, leaving the box drained and moderately dry. Then put in the bottom of the box about three or four inches of good fresh sawdust or shavings. Put the block of ice on top of same and cover the block on the top and sides with woolen blankets or carpets; with care a block of ice weighing 100 pounds can be kept in this manner nearly a week. If a smaller box is put within the larger, and the spaces well packed with sawdust or pulverized charcoal, a still better box will be had.

ANSWERS TO CORRESPONDENTS.

GRATE EXPLOSIONS—STRENGTH OF BRINE AND SALOMETERS—STORAGE TEMPERATURES AND MOISTURE—POWER TRANSMITTED BY BELTS—PRESERVING BUTTER.

[This department of ICE AND REFRIGERATION is conducted for the benefit of the trade generally, as well as individuals; and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

GRATE EXPLOSIONS.

To the Editor: We have heard of boiler explosions before this; but some nights ago we were treated to the, at least to us, quite novel experience of an explosion under the boiler, blowing out the furnace doors and doing quite a little damage besides. In spite of the novelty of the thing we do not care to have it occur again, and should like to know what may have been the cause of the accident, and how future accidents of this kind may be prevented. TH. L.

ANSWER.—Such explosions under the boiler, or grate explosions, as they are called, have been known to happen when the fire was not properly taken care of after quitting time, as, for instance, when the fire is banked on the grate while the damper is left closed and the ash pit doors are left open. Under these conditions inflammatory gases collect in the fire space and above, and, becoming mixed with just the right proportion of air, become explosive and go off in a manner similar to your experience. If in future your fireman banks the fire at night, he should see that the ash pit doors are closed tight and that the damper is left open, and we trust that you will not be troubled again by a similar accident.

STRENGTH OF BRINE AND SALOMETERS.

To the Editor: Please inform me how salty brine should be to make ice by using the can system, and what is the best way of measuring the density of brine. J. T. H.

ANSWER.—The first part of your question has been fully answered on page 291 of Vol. IV of ICE AND REFRIGERATION, as follows: "In order to give a definite answer to your question you should have stated the lowest temperature which obtains in your freezing tank. Generally speaking the brine must contain sufficient salt to prevent its freezing at the lowest temperature in freezing tank, and by referring to the accompanying table you can answer the question yourself on this basis very readily.

Percentage of Salt by Weight.	Percentage of Water by Weight.	Specific Heat of Brine.	Degrees on Salometer 60° F.	Freezing Point Degrees F.
0	100	1.000	0	32
1	99	0.992	4	30.5
5	95	0.960	2	25.2
10	90	0.892	40	18.7
15	85	0.855	60	12.2
20	80	0.829	80	6.1
25	75	0.783	100	0.

"Therefore if in your case the temperature in the freezing tank does not go below 15° F., it would be quite sufficient to use a brine containing 15 per cent of salt, (salometer degrees 60) as from the above table it appears that such a solution does freeze below that temperature. On the other hand, if the temperature of your freezing does not go below 20° F., a brine containing only 10 per cent salt would be sufficient for the same reason, etc. This table also explains why it would be irrational to use stronger solutions of salt than these, for, as we see from the column showing specific heat, the same grows smaller as the concentration of the brine increases, and consequently the stronger the brine the less heat and cold a given amount of brine will be able to convey between certain definite temperatures. There is another danger connected with the use of too strong, especially of concentrated brine in refrigeration. Such brine may cause clogging of pipes, etc., on account of depositing salt."

The above, also, in a measure disposes of your question relating to the measuring of the density in making reference to the salometer, which is simply a hydrometer scale, the degrees of which compare with density, specific gravity or strength of brine in the manner as shown in the above table. In case you should not be able to readily obtain a salometer, you can also use a Beaumé hydrometer, or a Beck hydrometer scale, both of which are in quite general use for taking the strength of acids, etc. Their degrees compare with specific gravity and percentage of salt, as shown in the following table, and, as will be seen, do not differ so very much from the degrees of the salometer scale:

Percentage of Salt by Weight.	Specific Gravity.	Degrees on Beaume's Scale, 60° F.	Degrees on Beck's Scale, 60° F.
0	1.0000	0	0
1	1.0072	1	1.2
5	1.0362	5	6
10	1.0733	10	12
15	1.1114	15	17
20	1.1511	19	23
25	1.1923	23	28

STORAGE TEMPERATURES AND MOISTURE.

To the Editor: There seems to be considerable difference of opinion as to the best temperature at which fruits should be kept in cold storage. What in your opinion is the best temperature for keeping bananas and lemons in cold storage? Is it necessary or desirable that the storage room should be kept absolutely dry? I understand there are chemicals which will keep a room dry; what are they, and how are they used? How can I ascertain the degree of moisture in the storage room? P. SCH.

ANSWER.—As to keeping bananas opinions in regard to temperature differ all the way from 36° to 50°, and as to lemons from 36° to 45°. We should judge that 40° is a safe mean for the latter and 45° for bananas. Lower temperatures appear to prejudice their keeping after being taken from cold storage. It is neither necessary nor desirable that the storage room should be absolutely dry; on the contrary, we think it may be too dry as well as it may too damp. If the room is too dry it will favor the shrinkage and drying out of certain goods. If the room is too damp goods are liable to spoil and become moldy, etc. For this reason the moisture should always be kept below the saturation point. This condition can be ascertained by means of a hygrometer, which essentially consists of two thermometers of exactly similar division suspended in proximity to each other. The bulb of one of them is wrapped in a strip of loose muslin dipping into water contained in a small vessel placed below the thermometer. If under those conditions the mercury shows alike in both thermometers it proves that the air is saturated with moisture, a condition which is prejudicial to most goods kept in storage; the thermometer with the wet bulb should always stand several degrees below that of the dry thermometer. There is little danger that the rooms will ever be too dry; on the other hand, they are not required to be absolutely dry, and as to chemical dryers we consider them superfluous with proper ventilation and refrigerating machinery properly applied. The

best chemical drying material, because cheap and efficient at the same time, seems to be chloride of calcium, which if dried absorbs considerable moisture, thereby assuming a liquid form. By redrying its absorptive qualities may be revived, and thus the same amount of substance may be used repeatedly over and over again.

POWER TRANSMITTED BY BELTS.

To the Editor: Please inform me through the next issue of your valuable paper, how many horse powers can be transmitted by a 10-inch belt and a pulley having twenty inches diameter and making eighty revolutions per minute. G. L.

ANSWER.—The amount of power that can be transmitted depends on the strain or tension of the belt, in the first place, and also on the lap of the belt on the pulley; if the driving and driven pulleys are of nearly equal size or sufficiently far apart so as to allow the belt to lap half round the smaller pulley, and if we allow forty-one pounds tension per inch width of belt, the above belt would transmit about 5-horse powers under the conditions named.

PRESERVATION OF BUTTER.

To the Editor: We have been advised to melt butter previous to filling it in jars in order to increase its keeping qualities. We have tried this on a small scale, but find that the butter so treated acquires a peculiar taste quite different from fresh butter. Is there any way to avoid this taste, and do you really think that it will help a great deal to preserve the butter? Are there any chemicals that may be used to preserve butter; and which, in your opinion, is the best way to preserve butter in its original condition? L. F.

ANSWER.—In order to melt butter so that the taste is not too much impaired, great care must be used in the performance of the operation, the safest way being to use a hot water bath instead of melting the butter in a vessel over direct fire, which scorches and decomposes the butter to some extent. For this purpose the butter contained in a glazed earthen jar is placed in a larger tin or iron vessel partially filled with water. Then heat is applied to the outer vessel until the butter melts in the inner one. After an hour or so the albuminous and easily decomposable constituents of the butter which coagulate by the heat, settle to the bottom, while a clear, transparent, oily layer of melted butter remains on top, covered with a thin layer of foamy substance. The latter being carefully removed, the liquid butter is poured into glass vessels which must be well sealed. We understand that this method of improving the keeping quality of butter was practiced to a great extent in Europe, and that butter so treated would keep for several months without losing much in flavor. For the sealing of the jars containing the melted butter, a layer of paraffin is recommended; others use artificial parchment paper, tied over the jars. Boracic acid, salicylic acid and other chemicals have been recommended to preserve butter, but, as far as we can learn, with very questionable success, owing, doubtless, in some measure, to the difficulty of intimately incorporating these ingredients with the butter. Our personal opinion is that salting and cold storage are the proper and best preservatives to keep butter in its original condition, other methods of preservation impairing the taste, flavor and grain of the butter to a greater or less extent.

——S. G. Arnold, Lyons, Iowa, has sold his ice to Allen & Mead, of Clinton, who will begin a retail business in the latter city, as well as at Lyons.

——Peter Shipe, of Shipe & Schmeck, ice dealers at Reading, Pa., has retired from that firm and gone into the ice business on his own account. He is handling manufactured ice.

NEW BOOKS.

TEMPERAMENT, DISEASE AND HEALTH. By French Ensor Chadwick. New York and London: G. P. Putman's Sons, 1892. 12 mo, cloth, pp. 85. Price, 75 cents. For sale by A. C. McClurg & Co., Chicago.

This little book is written primarily to expound the idea that there is associated with each individual temperament a specific rate of change (assimilative and secretive) and that the failure to keep up that rate, or, in other words, a failure to have elimination keep pace with accession of material, is the primal cause of organic disease. The subject as treated by the author offers many original and interesting aspects, which are readily accessible to the popular mind.

DIE THERMODYNAMIK IN DER CHEMIE. Von J. J. Van Laar. Leipzig: Wilhelm Engelmann. 1873. 8vo, paper, pp. 196. Price, 7 marks.

Among the physical disciplines which have been accessory to the remodeling of theoretical chemistry, thermodynamics are gaining in importance daily. Indeed, there are hardly any chemical changes or reactions, the thorough discussion of which does not require the application of thermodynamic principles. The subject which is generally referred to in a more casual manner in works on general and physical chemistry, is here treated in an independent, fascinating and exhaustive manner for the first time, comprehending all the known relations by uniform mathematical deductions, all starting from the same accepted principles. Although the German idiom suffers a little at the author's hand (he being a Dutchman), this does not seriously detract from the great value of the work, which is enriched by many instructive deductions original with the author. The work is dedicated to Van't Hoff, the well known exponent of physical chemistry, whose introductory remarks preface the book.

NATIONAL AMMONIA CO. St. Louis. 32mo, paper; pp. 48; free on application.

This is a "World's Fair Issue" of testimonials in reference to the anhydrous ammonia furnished by the National Ammonia Co., of St. Louis. It also contains a short treatise on ammonia. The users are among the most prominent builders and operators of refrigerating machines in this country, whose remarks will be interesting to the trade generally.

ROBB'S ANNUAL VEST POCKET GUIDE OF HUDSON. For the ice trade in general. By E. H. Robb, Staatsburg, Dutchess Co., N. Y. 68 pp.; leather; price, $1.

This is a little work for the vest pocket, comprising a map showing the location of all ice houses on Hudson river, with numbered index, giving names of owners, capacity of houses, and harvest of 1893; also most convenient railroad connections to each house; officers and depots of all companies and individual dealers in New York and Brooklyn; schedule of the closing and opening of the Hudson since 1824; beginning of harvest annually from 1870 to 1893, and other tables and information. It is a very accurate compilation and an exceptionally valuable pocket book for the eastern trade.

CATALOGUE. Arctic Machine Manufacturing Co., Cleveland, Ohio. Small 8mo; 38 pp., free on application.

This catalogue contains, besides some apt general remarks on refrigeration and ice making, a complete and explicit, though terse, explanation of the characteristic features of the Arctic ice machine, illustrations of the details of the compressor, of machines and plants, as well as a list of users, with the comments of many patrons on the working of the Arctic machine.

ICE MAKING AND REFRIGERATION. Hodges and Havenstrite Patents. By Westinghouse, Church, Kerr & Co. Boston. 8mo; 26 pp.; free on application.

This catalogue gives a complete and succinct description of the new type of refrigerating and ice making machine brought out by the above named firm. In form it is so marked a departure from usual and familiar types that our readers will certainly be interested in it. The circular will be sent on application.

SPIRAL RIVETED WATER PIPE. Abendroth & Root Manufacturing Co. New York city. 16mo, pp. 39; free on application.

This is a comprehensive catalogue of these well known goods, especially interesting and valuable from its thorough exposition of the various applications of riveted pipe, in the conduction of water and for circulating pipes in cold storage plants.

——The Grant Ice Co., Grand Rapids, Mich., has changed its name to the Grant Ice and Fuel Co.

THE ICE TRADE

SUNDAY ICE.

THE opinion of Chief Justice Fuller and his associates who heard the appeal, at Chicago, in the "World's Fair" Sunday-opening case, as reported in the daily papers of June 17—a preliminary opinion only, in entering the order which makes opening the Fair a legal possibility—does not, unfortunately, decide anything generally with reference to Sunday itself. Theological dicta in reference to the day, however, no longer have any place except in the consciences of individuals. That much is settled; otherwise we are of "the same opinion still"; that is, that Sunday observance is simply a matter of rest.

The "Continental" Sunday, which is in many respects and places as much a labor day as Monday or Friday, will never be popular in America, where the trend of opinion and events is toward fewer hours of labor; and being a day, now in the main without labor, it will, as a holiday, be maintained and its observance as such even more strongly demanded by the labor classes of this country. And this demand is reasonable. Six days of productive capacity is sufficient for our needs as a race, and except in particular instances where labor on the seventh is demanded by the unavoidable conditions of production, the demand for the one-day-in-seven rest is certain to be more forcible than it ever has been.

In the ice trade there is really no valid argument on which to base a Sunday delivery, except custom or habit. It is a requirement that has its origin in the selfishness of men who are perfectly willing to see other men work while they rest, which altruism ought long since to have abolished, but has not entirely; and the practice is a catering to selfishness that is not without objection as a mere altruistic principle—pure selfishness should never be pampered. Both men and horses handling ice need the seventh day rest, and they should have it, and can have it without annoyance to any one if the companies will simply announce that they will not deliver ice on Sunday, and insist on their trade taking double quantity Saturday.

That this will eventually be the case, there is little doubt. If the dealers do not bring about the reform themselves, the men may do it for them. It has frequently been discussed by them, but at Omaha, late in May, the local union of ice workers had taken the matter up. The matter has been handled judiciously, the men sounding the customers and in some cases getting their assent to a double Saturday delivery in lieu of one on Sunday. The assent of the dealers was then asked for, and four of the seven firms had on May 21 agreed to discontinue the Sunday delivery. The committee of the union hoped to secure the other three.

They hold, and truly, that no loss can accrue to the dealers, certainly none that would be appreciable; while the gain in energy of the men and effectiveness of stock would more than make up for any possible losses.

THE TRADE.

THE season opened late all over the north, owing to the conspicuously low temperature of April and May. Since June 1, however, the weather has been very warm, not to say hot, all over the country, and business in consequence has been good, at remunerative prices. The buyer, for once at least, can find no fault with the quality of his ice, which is manifestly excellent, and universally so; but as Polonius said of Hamlet, "he is still harping"—on the price. Even Pierre, S.D., joins in the fashionable plaint that "$12 for the season is too high"—and "it makes no difference how few months they desire ice"—nor how many? On the other hand, the Californians who have been paying 1@2c. a pound, who now get it for ½c. a pound, are happy—"anybody can keep cool at this price."

THE consolidation of the ice companies and dealers at Cincinnati, of which so much has been said during the past two months, appears at this time to have fallen through. It seems to be certain, in any event, that the Cincinnati Ice and Cold Storage Co. will not go into the new corporation, owing, as the directors claim, to a too low appraisement of the company's property. The *Tribune* of the 9th inst. says: "Mr. Russells, of the company, attended the general meeting on Wednesday and stated the attitude of himself and his fellows. He said, further, that the meeting need have no hesitancy in proceeding alone, as it would be better for the interest of the trade to have two than twelve or more competing firms. Then he was politely but firmly invited to leave the session, which he did, and the Cincinnati is out of the deal. It is expected that the remaining firms will close up their combine within a few days."

ON JUNE 21, according to the *Eagle*, a number of Brooklyn ice dealers held a meeting on the 20th to fight the wholesalers—"the trust," as they call it—who have raised the price once this season and threaten to make another advance. They claim that Mr. Morse, who bought recently the Ridgewood company's property, is responsible for the higher prices. The retail men discussed plans for organizing a union. Another meeting, at which permanent organization will be effected, will be held in about ten days. Two years ago the retailers had an organization which contained 380 members.

A "SLUMP" in prices of 15 cents per cwt. (from 50 to 35 cents) is reported at Columbia, S. C., where Mr. Geo. C. Romanstine has recently established an agency for the Augusta Ice Co.

THE Savannah (Ga.) Crystal Ice Co. will hereafter wholesale its ice to the Savannah Ice Delivery Co., which company is handling also the ice of the Gorrie and Knickerbocker companies.

THE government at Washington city has accepted a bid for furnishing the departments with ice for the next season—1,200 to 1,500 tons. The first lot of bids received were: Great Falls Ice Co., 34½ cents per 100 pounds; Hygienic Ice Co., 35½ cents; the National Capital Ice Co., 36 cents, and the Independent Ice Co., 34 cents. The last named company holds the contract for the present year at the rate of 18½ cents per 100 pounds. Its bid for next year is 34 cents per 100 pounds, and was the lowest one received. The second lot of bids was substantially the same as the first lot, except that the Great Falls bid 31 cents, and one bid was received of 27½ cents from Philadelphia. There was a discussion of the committee of the plan of buying by schooner load, and having the government tug haul it up the Potomac; but on the 25th the committee accepted the bid of the Fairmount Ice Co., of Philadelphia, at 20 cents per cwt.

TRADE PRICES AND NOTES.

——Esch Bros. & Rabe, Chicago, are hauling six to ten cars daily from their houses at Oswego, Ill.

——The big crop made for Boston, etc., at Brookline, N. H., has been moving out rapidly since June 1.

——A war is going on between the dealers at Point Pleasant, N. J., and ice has been gone to 35c. per cwt.

——Prices at Newark, N. J., will remain the same as last season, 50c. per cwt. in four deliveries of 25 lbs. each.

——E. H. & C. H. Rollins have begun shipping ice from Bangor, Me., to Philadelphia, June shipments being no less than 2,000 tons.

——The D. Brown Ice Co., Sandusky, Ohio, announce that they will fill private family ice boxes each day for only $1 per month, and furnish saloons at 10 cents per cwt. and other lines of business at proportionately low prices.

——G. C. Romanstine has opened an ice agency at Columbia, S. C., for the Augusta (Ga.) Ice Co. The Palmetto Ice Co. has been getting $10 wholesale and $15 retail, or 22 tickets for $1; and it is hinted that the new agency will cut the price to $7 (@$8, or 30 tickets for $1.

——There is at least one reporter who deserves "honorable mention." His name is not on record, but he lives at Atchison, Kan., and says: "Ice that sold at sixty cents a hundred last summer will be sold for forty this. The ice men, like the devil, should be given their due. When ice is plentiful the price is lowered."

——The Central Ice Co., Los Angeles, Cal., a new competitor for business, announces rates of 10 to 20 lbs., 1c. per pound; 25 to 100 lbs., 75c. per cwt. The company's advertisements say: "As a special inducement we offer an annual subscription to the *Ladies' Home Journal* to all taking ice from us from June 15 to November 1 in quantities of ten pounds and upward." Next!

——The Great Falls Ice Co. finished shipping at their South Gardiner (Me.) houses for the present, June 16. The Greens Ledges houses were opened next. The company has shipped all the ice from the north houses, and the buildings have been torn down to make room for the new ones to be built this season. They have also shipped out one room of their south houses.

——The Mountain Ice and Cold Storage Co., Salt Lake City, Utah, are now selling manufactured ice at the following rates: Books of thirty 10-lb. coupon tickets, $2.75 each: books of thirty 15-lb. coupon tickets, $3.60 each; books of thirty 25-lb. coupon tickets, $5.25 each. The books are sold for cash only, and the ice is thereby 10 per cent cheaper to the customer than last year's rates. No collectors are employed whatever, all ice being sold by the coupon book system.

——The Madora Refrigerating Co. has been incorporated at Chicago, to carry on the business of manufacturing and dealing in refrigerators and secure patents for improvement of same; capital stock, $50,000, incorporators, Mary Madora Harris, Granville E. Harris and Franklin Denison.

NEW ICE FACTORIES.

THE building season is now supposed to be over for this year's consumption, nevertheless there appears to be considerable new work going on. We note a number of recently built factories starting up in the northern states, all of which seem to begin their work under favorable auspices. Our record of repairs, new work, etc., is as follows:

ALABAMA.

Opelika.—The ice factory was sold June 3 to Messrs. Butler & Klien, of La Grange. These gentlemen will put in new machinery at once and the factory will begin operations within thirty days.

DISTRICT OF COLUMBIA.

Washington.—On June 5 the Fairmount Ice Manufacturing Co., filed articles of incorporation. The capital stock of the company is placed at $300,000, divided into 3,000 shares of $100 each. The trustees for the first year are: W. W. De Saville, J. B. Devine, C. C. Duncanson, L. C. Robbins, J. E. Beall, H. W. Garnett, John H. Magruder, John T. Trego and H. A. Robbins.

FLORIDA.

Apalachicola.—Wells & Green, of Pensacola, will erect an ice factory and fish packery at Apalachicola.

Eau Gallie.—A 10-ton ice factory will be erected.

Key West.—The new ice factory noted heretofore to be erected here will have a Sulzer-Vogt Machine Co.'s (Louisville) machine of twenty-five tons capacity.

Lake City.—Wm. R. Bush is said to be in the market for a 6 to 10-ton ice plant complete (no engine).

Tallahassee.—A recent telegram from this place says that "Mr. Keifer, of the Thomasville Ice Co., has made an offer for the site and good will of the Tallahassee ice factory, and if he does not succeed in buying, he will build a factory—a substantial brick building, supplied with the latest improved machinery, to make ice from the city water distilled. It is his purpose to supply towns east and west on the line of the F. C. & P. railroad."

IOWA.

Davenport—The Crystal Ice and Cold Storage Co. have begun making ice.

LOUISIANA.

New Orleans.—The New Orleans Brewing Association will hereafter manufacture its own ice used when shipping beer. The plant will be located in the old brew house of the Southern brewery. The power will be furnished from the plant of the brewery in operation there, and the engineers of the brewery will have charge of the new departure. The daily capacity will be fifty tons, using filtered Mississippi water.

NEW MEXICO.

Aztec.—It is said that an ice factory will be built here.

PENNSYLVANIA.

Chester.—An ice company has been formed at Moore and one at Folsom. The building for the manufacture of the ice is now being built on the property of J. L. Price, near the brick row north of Moore. The other company is refitting the old ice plant at Folsom. Josiah Stone, of Ridley Park, and Mr. Moulton, formerly of Ridley Park, are interested in this plant.

Greensburg.—The Greensburg Ice Co.'s new plant began operations June 3.

New Castle.—The Treaser ice factory has begun operations.

Ogontz.—W. H. Shoemaker has begun making ice.

TENNESSEE.

Dyersburg.—The Dyersburg Ice and Coal Co., J. M. Bowling, president, W. O. Brandon, superintendent, have just finished erecting a $15,000 plant. They use a Boyle machine.

TEXAS.

Abilene.—The Abilene ice factory began operations May 29.

Alice.—It is reported that this place is to have an ice factory.

Denison.—C. W. Dawley, Russell Myrick and A. H. Coffin have incorporated the Choctaw Ice Co., with a capital stock of $50,000.

Fort Worth.—The Fort Worth Ice Co. has just put in a new 50-ton machine, built in that city for them.

New Braunfels.—John Sippels has built an ice factory.

UTAH.

Ogden.—Ice from the new factory was put on the market June 5.

VIRGINIA.

Alexandria.—The Cameron street ice factory began operations June 5.

OBITUARY RECORD.

DEATH OF JAMES E. COCHRAN, OF THE COCHRAN-OLER ICE CO.—EDWARD E. CONKLIN, OF NEW YORK, PASSES AWAY—OTHER DEATHS IN THE TRADE.

JAMES E. COCHRAN, president of the Cochran-Oler Ice Co., Baltimore, Md., died at his home in that city June 10.

Mr. Cochran was born in Harford county, near Aberdeen, at the old family homestead, June 28, 1816, and resided there until 1831, when his family moved into Baltimore and located near what is now known as North avenue, then given over to pasture and cultivation. He was educated in Baltimore, and when quite young engaged in the oyster business on Light street wharf and was very successful, and even at this early period laid the foundation of the fortune which he afterward accumulated.

Some years after he embarked in the wholesale grocery business with Mr. James Dowell near the same location, and built up a large and flourishing trade with the lower counties of Maryland and other trade tributary to Baltimore. His brother, Mr. Thomas J. Cochran, had meanwhile established the ice business, which proved successful. Failing health, however, compelling him to sever his connection with this growing industry, he sold out his interest to his brothers, Messrs. John and James E. Cochran, who then associated themselves with the late Woodward Abrahams, continuing the name of Cochran & Co. This firm, being the pioneers in this business in Baltimore, maintained their leading position and made the name of Cochran & Co. a household word in that city.

In 1886 a consolidation with the firm of Oler & Co. was effected and a stock company under the name of the Cochran-Oler Ice Co. incorporated. Mr. Cochran was actively associated with the management of the business and never relinquished his daily oversight of affairs, although somewhat feeble in health, until after May 1. He has been failing visibly since the first of the year, and an untoward accident which happened to him while harvesting ice upon the Susquehanna in January, it is thought, hastened his dissolution. He incautiously walked out on thin ice and was precipitated into the cold water, and being some distance from the working force, his rescue was delayed until he was quite exhausted, and it was with great difficulty that he was drawn from what came near being a watery grave. Every provision was promptly made for his comfort and to avert any ill effects of the drenching he received, but it is thought the shock affected his nervous system in such a way as to shatter his vigorous constitution and stalwart frame. Some weeks prior to his death his mind became impaired and his decline thereafter became rapid in spite of best professional skill and careful nursing.

He was one of the most genial and companionable of men, charitable and sympathetic, and his integrity and probity were only equaled by his untiring energy and close devotion to business. He was a member of the I. O. O. F. and one of the oldest surviving members of the Corn and Flour Exchange. He leaves eight children.

President Rodgers announced Mr. Cochran's death on the floor of the Corn and Flour Exchange, and appointed a committee to attend the funeral, which took place June 12.

EDWARD E. CONKLIN, DECEASED.

E. E. Conklin, a trustee and superintendent of the Knickerbocker Ice Co., of New York, died at Nyack June 5. He was seventy-four years old, and leaves a widow and four adult children. Mr. Conklin was one of the firm of A. Barmore & Co., who, with others, founded the Knickerbocker company. He was a pioneer in the construction of ice tools, wagons and ice machinery, having taken out several patents in these lines, notably the hoisting machinery for discharging ice from barges. Mr. Conklin was widely known over all the river counties as "Bossy Conklin," his genial nature endearing him to all he met.

OTHER DEATHS.

——William Bartlett, for twenty years a well known citizen of Brockton, Mass, died at his home in Raymond, N. H., Tuesday, June 6, aged nearly eighty-one years. Mr. Bartlett was the pioneer in the ice business in Brockton. He leaves three sons.

——John Hilt, president of the John Hilt Ice Co., Laporte, Ind., died in that city June 17, of brain trouble due to overwork. He was sixty years old, and one of the wealthiest and best known business men in northern Indiana.

——B. Street, of Aurora, Ill., died in that city May 30, after a long illness. He was seventy-nine years old. He went to Aurora in 1837, and for many years was in the ice business there.

——J. A. Squire, of Battle Creek, Mich., died suddenly in that city of heart disease, June 2. He was sixty years old, and one of the oldest ice dealers in the city.

FIRE AND ACCIDENT RECORD.

——F. F. Brierly's ice house, Beaver, Pa., was burned June 7; loss, $200.

——John Collier's ice house at New Brunswick, N. J., was burned May 27.

——Thomas Summerville's ice house at Bunker Hill, Ill., was burned May 21.

——A fire injured the roof of the "Bee" line ice house at Galion, Ohio, June 14.

——Earl & Bishop's ice house at Ludington, Mich., was burned May 27; loss, $3,000.

——J. T. Barhydt's three ice houses at Schenectady, N. Y., were burned June 8; insured.

——A portion of the ice house of the Waterford Ice Co., Waterford, N. Y., was undermined by water May 28; loss, $350.

——The lard refinery at Swift & Co.'s packing house, Chicago, was damaged by fire to amount of $5,000, June 14; insured.

——John Quigley's ice house at Rondout, N. Y., was burned May 25 and 1,000 tons of ice destroyed; loss, $5,000; insurance, $1,800.

——During the floods of June 5 the Jackson (Mich.) Ice Co.'s houses were undermined by water, and from 200 to 300 tons of ice were destroyed.

——The local ice house and office of the National Capital Ice Co., Washington, D. C., were damaged by fire and their stables burned June 5; loss, $1,500; insured.

——Louis Singer's four ice houses and stable at McKee's Rocks, near Pittsburgh, Pa., were burned May 30; loss, $5,000; uninsured; cause, supposed incendiary. The horses were saved. The ice stored was owned by Otto Buettner and Frank Bryan.

NATURAL ICE NOTES.

——Dr. Baker, Baldwinsville, Mass., is building an ice house.

——The Wagner Lake Ice Co., of Sandusky, has opened an office at Toledo, Ohio.

——The Sylvan Lake Ice Co. has been incorporated at Detroit, Mich.; capital stock, $25,000.

——The J. L. Miner Ice Co. has been given the city government ice contract at Detroit, Mich., at 15 cents per cwt.

——Wm. Zastrow, late of the Helena Ice Co., has organized the O. K. Ice Co., Helena, Mont., beginning business June 1,

——The Chas. Timeus ice house at Sidney, Ohio, recently burned, has been rebuilt around the ice, most of which was saved.

——The Kissena Lake Ice Co., Flushing, N. Y., will this summer clear the lake bed of vegetation, and begin the work of enlarging the lake in order to make it fit for an ice harvest field.

——The new owners of the Middlesex Ice Co., Malden, Mass., will build four new ice houses at Pentucket pond, Topsfield, this season, as a substitute for harvest fields and storage houses required at former territory by the city of Malden. The company is building also a stable 175×45 feet in size.

MR. SECRETARY MORTON, of the department of agriculture, is reported in the daily press as about to make a reduction in the force of meat inspectors throughout the country, basing his purpose on the fact that the exportation of meats inspected has been less since inspection began than it was previously —not, of course, because of inspection, but in spite of it. He holds, therefore, that the system has had no beneficial results to the trade, and that Germany in particular, one of the largest buyers, has its own inspectors, through whose hands all meats must pass for inspection, notwithstanding their prior inspection in America and label to that effect.

THE Chicago Packing and Provision Co., London and Chicago, with packing houses at Chicago and Omaha, Neb., reduced its last regular dividend on ordinaries from 15 to 12½ per cent. The previous interim dividend was at the rate of 15 per cent per annum. The official report says that "the company in Chicago is about 154,000 head short of last year's purchases, and the rate per head of the hog has advanced about $1. The other figures in the accounts remain very much the same as they were last year. The Chicago company claim to have a surplus of $188,756; they claim undivided profits of $424,179, from which, however, has to be deducted the present dividend, together with the fixed charges for the time. The bonded debt remains the same ($650,000)."

THE packing industry of Kansas City has rushed to the front during the twelve months as it has not for years. The beef, hog and mutton capacity has been increased from 40 to 60 per cent, says the *Journal*. There are eight packing establishments here, in which over $16,000,000 is invested, and between 6,000 and 9,000 men are employed, according as the time of the year and supply and demand make the pace. Packers and dressed meat men purchased at the stock yards during the year $48,-500,000 worth of raw material upon which to operate, and it is estimated that the value of the same when ready for market made the grand aggregate of $64,000,000. At present the largest packing house in the world is situated at Kansas City. For the year closing June 1, packers and dressed meat men used 78,834 head of cattle, 54,-700 calves, 1,927,826 hogs, 249,783 sheep. It is a noteworthy fact that very few at present of the medium weight class of cattle are sent on from Kansas City in first hands, but are taken out by local dressed meat men. The sheep coming here that are fit for the butcher are about all sold to local packers, and the same is true with reference to hogs to a greater extent than ever before.

PACKING HOUSE NOTES.

——Armour & Co.'s beef refrigerator at Scranton, Pa., was burned June 26; loss, $15,000; insured.

——It is announced that the Fort Worth (Tex.) packing house will start up for business on or about July 1.

——The new Armour cooler, at Glens Falls, N. Y., has been finished. The cooler is 25×50 feet in size, and the ice room holds 160 tons.

——The Armour ice house, at Wilkinsburg, Pa., has been torn down for removal to Altoona, where the new icing station has been erected.

——The Whittaker packing houses in St. Louis and Wichita, Kan., are in financial difficulties, owing, it is said, to a disagreement between the owners, and the plants have been attached by creditors.

——Swift & Co., Kansas City, shut down the hog department June 16, owing to scarcity and high price of hogs. The other packing houses in the city have reduced the number of their hog department employes.

——An effort is being made to organize a butchers' association for the purpose of building slaughter and packing houses, etc., at Knoxville, Tenn. Charter has been applied for. W. B. French, J. M. Kirby, R. M. Plumlee and others are interested.

——Messrs. Nelson Morris & Co. have plans completed for a new cooler at Poughkeepsie, N. Y. The building will be in the shape of the letter L, 116 feet 3 inches deep by 20 feet wide, with an L of 35 feet, which will be used as an office. The building will be two stories high.

RAILWAY REFRIGERATION NOTES.

——Mr. Canda, of New York, is having five refrigerator cars built at Huntington, W. Va., from his own models, which when finished will be tested on the Southern Pacific railroad.

——A joint circular has been issued by the American Refrigerator Transit Co., the Santa Fe Fruit and Refrigerator line, the Louisville & Nashville Railroad Co., the Missouri Pacific, the Missouri, Kansas & Texas, the Mobile & Ohio, the Cairo Short Line, the St. Louis & San Francisco and the St. Louis Southwestern Cotton Belt announcing that on and after May 24, and until October 1, icing charges will be made on shipments in refrigerator cars in addition to regular tariff rates from St. Louis as follows: To Memphis, $8 per car; Van Buren, Little Rock, Fort Smith, Pine Bluff, Camden, $10 per car; Texas, Mississippi and Louisiana points, $15; Birmingham, Selma, Montgomery, $15 per car. This will not apply on shipments of packing house products and beer, as those shippers furnish their own ice.

——The American Rolling Stock Co. has been incorporated at Omaha, Neb. South Omaha will be headquarters of the corporation, and the capital stock is fixed at $500,000, divided into shares of $100 each, which is to be fully paid in when the certificates are issued. Business was begun June 1, 1893, to continue for thirty years. The incorporators are Michael Cudahy, H. L. Kreider, W. M. Keenan, John Forbes and John S. Knox. It is stated that the enterprise is entirely distinct and apart from the Cudahy Packing Co., although that corporation is heavily interested in it. The company will operate all kinds of cars, furnishing refrigerator cars to packing companies and stock cars to live stock shippers. It is further designed to obviate the trouble that the packing company has experienced by the railroads loading their empty cars and sending them to a second destination before they are returned to their starting point.

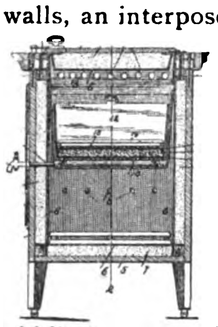
——Mr. Sickles, representing A. S. Cook & Co., of Florida, early in June was at Fort Valley, Ga., fitting up some E. T., V. & G. railroad cars, with his center ice vault, which he promises will revolutionize fruit refrigeration. Heretofore refrigerator cars have only been fixed with ice vaults either on top or at each end, holding from three and one-half to five tons of ice to the car, and leaving the greater amount of the fruit in the car farthest from the ice. "In end icers the fruit in the center of the car was twelve feet from the ice," says this inventor. "With the Sickles device the car will carry six tons of ice, which is so distributed that not a single crate of fruit is more than thirty inches from the ice, which, it is claimed, will cause peaches to be carried to market in much better condition than it is possible to carry it in end and top icers. This center ice vault is put in the center of the car, with sufficient ventilation to start a current of air, and as the cars are provided with small trap doors, the hot air can be allowed to escape, and the temperature of the car reduced rapidly to 40° while it is a hard matter to reduce end and top icers lower than 47° with all the ice they can pack in. This device is pronounced the best yet seen by fruit shippers, and they think they will get their fruit to market in better condition than it was ever known to be carried before." The fruit business is rapidly increasing in southern Georgia, and in consequence, while last year there were only three refrigerator car companies seeking this traffic, this year there are seven different refrigerator car lines there already, "and more expected." Hence fruit shippers are not liable to want for refrigerator cars this season. The melon crop of Georgia started north about June 1. The first car load was shipped from Albany, Ga., to Cincinnati, while now they are coming north to all the big markets, from Boston to St. Paul. Melon growers say the crop will be unusually large and that the melons will be of good quality. About 10,000 acres are planted to melons in southwest Georgia alone. An idea of the size of the shipments can be gained when it is stated that the Georgia Central Railroad Co. expects to ship 3,000 car loads. The Chicago demand, it is expected, will be very large, and the growers anticipate realizing good prices for the fruit.

We append below the most important new patents relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for ICE AND REFRIGERATION.

REFRIGERATOR.

No. 498,400. Charles C. Lockstaedt, Chicago, Ill. Filed December 18, 1891. Serial No. 415,456. Patented May 30, 1893. (No model.)

Claim.—1. A refrigerator having outer and inner walls, an interposed layer of bibulous material, openings or perforations in the inner side walls, and openings or perforations in the outer wall, whereby moisture absorbed by said bibulous layer through openings or perforations in the inner side walls can evaporate through said openings or perforations in the outer wall, substantially as described.

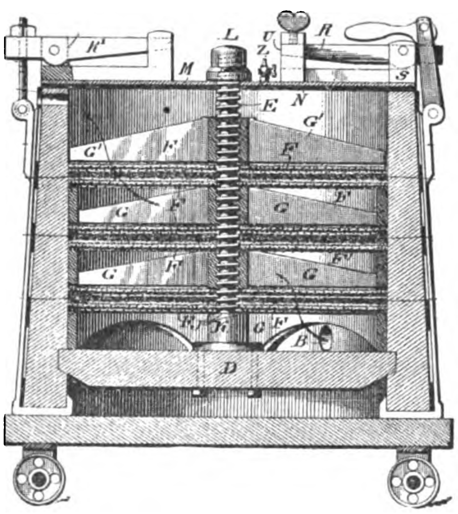


2. A refrigerator having outer and inner walls, an interposed layer of bibulous material, openings or perforations in the upper portion only of the inner side walls, and openings or perforations in the outer wall, whereby moisture absorbed by said bibulous layer through openings or perforations in the inner side walls can evaporate through said openings or perforations in the outer wall, substantially as described.

FILTER.

No. 498,544. Charles C. Froelich, Pottstown, and William Lorey and Henry Guenther, Philadelphia, Pa. Filed July 11, 1892. Serial No. 439,577. Patented May 30, 1893. (No model.)

Claim.—1. A filter consisting of a tank having a screw with a continuous thread rising from the bottom



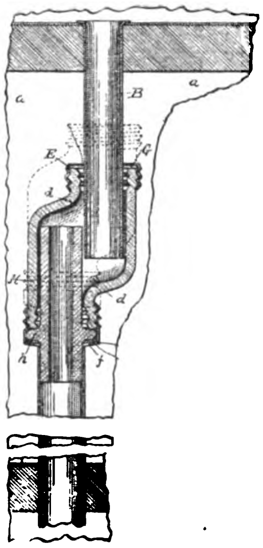
thereof, spiders with hubs adjustable on said screw, and arms with rims integral therewith, said arms having portions of reduced height, screens between said spiders, said tank having an inlet below the lowest spider, said parts being combined substantially as described.

2. A filter having a tank with screens and filtering material between the same, and diaphragms adapted to retain said screens and compress said material, in combination with a screw rising from the bottom of the tank of the filter, passing through the screens and diaphragms and the end of the tank, and a nut which is fitted on the upper end of the screw and tightens against said lid, said parts being combined substantially as described.

REFRIGERATOR.

No. 498,612. Henry C. Beardsley, New Duluth, assignor to Charles Hurd, Duluth, Minn. Filed April 21, 1892. Serial No. 430,064. Patented May 30, 1893. (No model.)

Claim.—1. In a refrigerator an upper drip pipe leading from the ice receptacle, in combination with a separate lower pipe *C* leading out from the refrigerator, and an independent cast glass trap, adapted to connect the said pipes and detachable at will therefrom without removing either of the pipes, substantially as described.



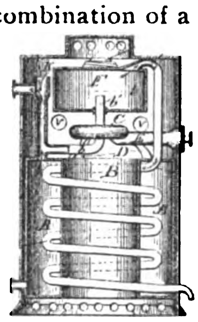
2. In a refrigerator, the trap *D* cast in glass and provided with the threaded necks *d*, *d'*, in combination with the perforated screw caps *E* and *F*, the glass tube *H* secured in the lower neck of the trap by the cap *F*, the rubber gasket *G* secured on the upper neck by the cap *E*, and the drip pipe fitting closely said gasket, substantially as described.

3. In a refrigerator, the glass trap *D* provided with threaded necks *d*, *d'*, in combination with the screw caps *E* and *F*, the wide rubber gasket *G*, the drip pipe *B* closely fitting said gasket, the glass tube *H* provided with flange *h*, whereby it is secured in the neck *d'* by the cap *F*, and the lower or outlet pipe *C* fitting upon the projecting end of the tube *H*, substantially as described.

APPARATUS FOR DISTILLING WATER.

No. 497,742. Winslow Allderdice, Warren, Ohio, assignor to William H. Allderdice, Washington, D. C. Filed November 4, 1892. Serial No. 451,019. Patented May 16, 1893. (No model.)

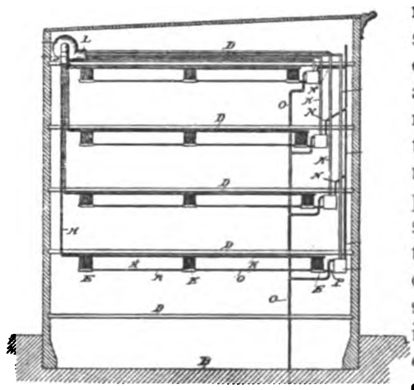
Claim.—1. In an apparatus for distilling water, the combination of a main casing, provided with an annular condensing tank in the lower part thereof, a boiler in the upper part of said casing and a condensing coil leading from said boiler through said annular tank, a pipe opening into said condensing tank near the base thereof for supplying water thereto, an overflow pipe opening upward to the atmosphere and connected to the upper part of said condensing tank and a feed pipe connecting the upper part of said tank with said boiler terminating below the level of the overflow opening and means for heating said boiler, substantially as and for the purposes described.



REFRIGERATING APPARATUS.

No. 500,088. Martin Wanner, Denver, Colo., assignor of eleven-twentieths to William B. Crittenden and John M. Millman, same place. Filed December 8, 1892. Serial No. 454,459. Patented June 20, 1893. (No model.)

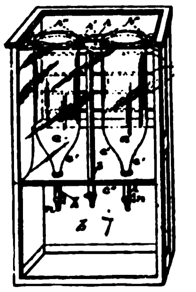
Claim.—1. The combination in a refrigerating apparatus, of a reservoir containing the refrigerating material, receptacles for the said material, connected with the reservoir and in which the material may be exposed to the action of a vacuum, more or less perfect, a pipe connecting the said receptacle with the device which produces the vacuum, said vacuum producing device, and an overflow for said reservoir located below the junction of said pipe with said receptacle, substantially as set forth.



MILK COOLER.

No. 499,840. Charles L. Kneeland, Lansing, Mich. Filed September 29, 1892. Serial No. 447,306. Patented June 20, 1893. (No model.)

Claim.—1. The combination with the casing, of the water tank therein having a glass front, the ice chamber above the bottom of the tank and connected to said tank, and a grating between the ice and water chambers.



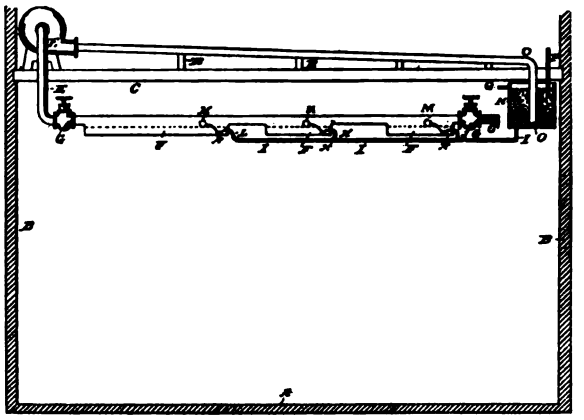
2. The combination with the casing, the water tank therein, and the cans mounted upon the bottom of said tank, of the elastic bands secured to the casing and drawn around the cans, and provided with hooks engaging with the tops of the cans.

3. The combination with the casing, the water tank, and the cans mounted upon the bottom of said tank, of the ice chamber connected to the water tank, and the grating separating them.

REFRIGERATING APPARATUS.

No. 500,107. Martin Wanner, Denver, Colo., assignor of one-half to William B. Crittenden and John M. Millman, Bucyrus, Ohio. Filed December 8, 1892. Serial No. 454,458. (No model.)

Claim.—1. The combination in a refrigerating apparatus of a reservoir adapted to contain the refriger-



ating material, a receptacle for the said material, connected with the reservoir, in which receptacle the material may be exposed to the action of a current of air, a pipe open to the exterior atmosphere and connecting said receptacle with the device which produces the current of air, and said device, substantially as set forth.

WANTED AND FOR SALE ADVERTISEMENTS.

[*The charge for advertisements in this column is $2 each insertion for seventy words or less, and twenty-five cents for each additional fourteen words. No advertisements will be inserted unless accompanied by the necessary cash. Parties answering these advertisements must write to the addresses given, as the Publishers decline to furnish any information concerning them.*]

For Sale.

Good second-hand ice machine, in perfect running order. Address "P. K.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

For Sale.

12-ton absorption ice making machine in perfect order. Can be loaded and shipped at once. Price $4,000 F. O. B. cars, with New York rate to destination. Address, F. B. CONOVER, Long Branch, N. J.

Situation Wanted as Engineer

In either ice factory, cold storage warehouse or brewery; or would take small interest in either. Understand either absorption or compression system. First-class reference. Address, "G. K." 106 Eleventh st., Hoboken, N. J.

Partner Wanted.

In a business that is already well established, and on a good paying basis, in a large and centrally located city. He must have from $5,000 to $10,000 to put into business. Write for particulars to "W. P. B.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Situation as Engineer.

Engineer wants situation. Familiar with all the details of ice making and refrigeration. Now holding position of chief engineer in ice factory in city on South Atlantic coast. Want to make a change on family's account; can come at one day's notice. Address, "A. F. A. M." care of ICE AND REFRIGERATION.

Engineer Wanted.

A thoroughly practical man for a 5-ton compression ice plant in Jamaica, West Indies. Must be able to make repairs and furnish references. None but experienced, sober man need apply. Best board and lodging here is $25.00 per month; climate healthy. Address, stating salary expected, W. J. FRANCKE, Montego Bay, Jamaica, West Indies.

Second-Hand Ice Machinery for Sale.

Two compression machines, one of 12-ton refrigerating capacity or 5-ton ice making, and one of 24-ton refrigerating capacity or 10-ton ice making, can be purchased for less than cost. They are guaranteed equal in every respect to the best new machines now on the market. Address for particulars, "S.W.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Position Wanted

With some concern either manufacturing or contemplating the manufacture of ice and refrigerating machinery, by young man of several years experience, and thoroughly acquainted with all departments of the business. Can furnish best of references and bring to the concern some valuable improvements. Address "H. A.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

ICE AND REFRIGERATION ILLUSTRATED

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

VOL. V. NO. 2. CHICAGO: NEW YORK: AUGUST: 1893. $2.00 PER ANNUM.

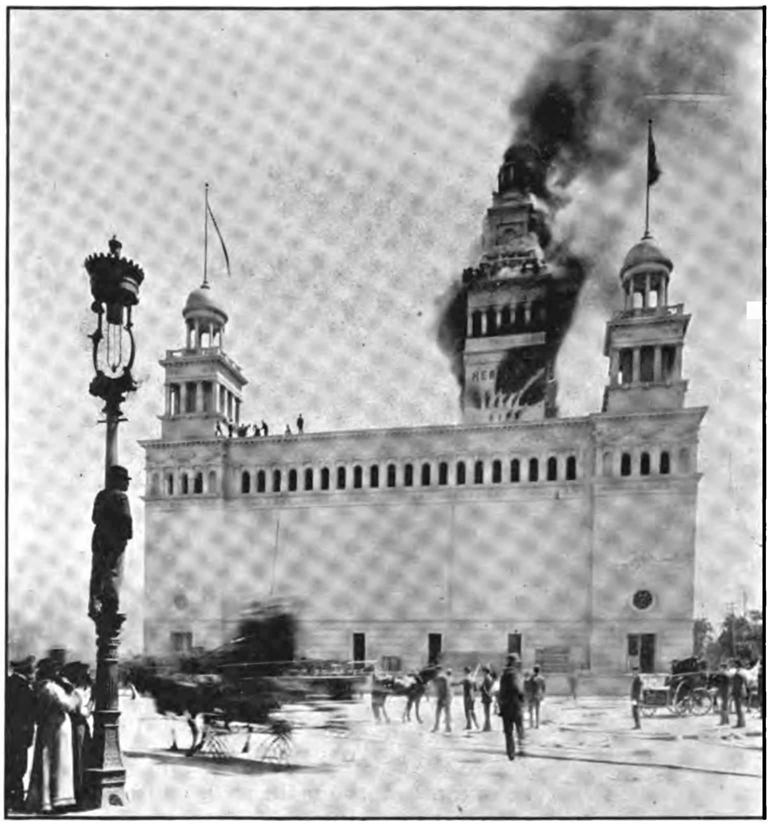
THE COLD STORAGE FIRE.

BURNING OF THE HERCULES IRON WORKS COLD STORAGE HOUSE AT THE WORLD'S COLUMBIAN EXPOSITION—SERIOUS LOSS OF LIFE AND MONEY.

THE burning of the cold storage house at the World's Fair on July 10 last, was one of the most appalling calamities Chicago has seen in many years, and it will be, probably, one of the most serious American casualties of the year 1893. The great loss of life, the large money value destroyed, and the tremendous rapidity with which the destroying element accomplished its terrible work will ever mark it an exceptional one in the history of the calamities of late years.

This cold storage and ice making plant, as readers of ICE AND REFRIGERATION will remember, was erected by the Hercules Iron Works, of Chicago, under a contract with the World's Columbian Exposition Co., on the basis of a concession to the Hercules Iron Works, which company, in return for the payment to the World's Fair company of a certain percentage of the receipts, had the exclusive right to sell all the ice used on the grounds controlled by the Exposition, and the exclusive right to furnish the cold storage space used thereon by other concessionaires and the exhibitors.

In order to make the ice and to provide cold storage facilities, the Hercules Iron Works erected the building which was illustrated and described in the December issue, 1892, of this journal. The building stood nearly due west of the Administration building, and was 130×255 feet in size. It was five stories high, with observatory towers on the four corners and a central tower 191 feet high which was the smoke stack of the boiler room. The upper floor was open, intended originally for a grand promenade, a fine view of the grounds having been obtainable from this floor, through the continuous row of columns on the four sides, which supported the frieze just under the roof. In June, however, the top floor was in part converted into a skating rink, the east half of the floor, for a space of 54×208 feet, having been piped for the circulation of brine, on which pipes four to six inches of ice were to have been frozen, affording a magnificent sheet of ice for skating. Around this sheet of ice was a broad promenade for spectators, while the west half of the floor would have served for a café and smoking room. The work of piping this floor had just been finished, freezing had begun, and in a few hours more the rink would have been opened to the public for skating. Franklin P. Burnham, the architect of the building, prepared all the plans and specifications for the ice rink, which were generally regarded by experts to have been the most perfect arrangement of this kind that has ever been carried into execution. Four elevators were in operation, one at each corner, to lift visitors to the rink floor, and four stairways also existed.



BURNING OF COLD STORAGE HOUSE AT WORLD'S FAIR—SHOWING FIREMEN IMPRISONED ON THE TOWER.

The engine room was in the center of the building, opposite the east entrance, and contained three Hercules ice machines of 300 tons capacity. The ice tanks in the south end of the building, opened in May, were making

over 100 tons of ice daily, while the north end of the plant, opened in April, was devoted to cold storage, and contained an immense amount of provisions, meats, fish, cheese, wines, mineral waters, etc., as well as fruit held for pomological exhibitors, most of whom, about the first of May, removed their fruit from the cold storage houses in the city to this plant.

How the fire originated will probably never be known, in spite of the confident *dictum* of the daily press that the chimney shaft was imperfectly constructed, in not having been provided with a thimble guard, as called for by the architect's specifications. If this were true, the smoke stack would have ended below the top of the wood work of the tower, leaving such wood work in unprotected contact with the smoke and heat from the chimney; and would have permitted the hot soot to drop down the shaft outside the iron stack and upon the wooden shell of the tower.

However this may be (and it seems a hardly credible solution of all the mysteries of this remarkable fire, in spite of the fact that it is the fire department's theory), about 1:00 o'clock of July 10, a small blaze was discovered at the top of the tower or chimney; and to the alarm sent in the fire department of the Exposition and the Columbian guards responded. No one seems to have dreamed of a serious fire, and the work of extinguishing the blaze appeared to be but the work of a moment. Led by Captain Fitzpatrick, the firemen attacked the flames by ascending almost to the top of the smoke stack tower. It was, however, a comparatively long time before any water was thrown upon the building, and then only one stream at insufficient pressure was available; and no water was at any time thrown upon the burning tower. It is also certain that Marshal Murphy and Capt. Fitzpatrick were notified of the existence of fire below the tower in the main part of the building itself. The graphic words of a contemporary tell the rest of the story:

"A more deceptive fire has been rarely known; for while the score or more of men were working high in the air, the flames seeming to the thousands of spectators who had gathered as though they might be at once put out, they burst forth with an appalling fury many feet below, cutting off without warning the men above. Marshal Murphy ordered his men down from the doomed structure by means of the life lines which they had brought. One by one these ropes were lowered, to be instantly cut in twain by the greedy flames, which rose higher to the balconies above. Then came the realization that all hope was lost, and this body of gallant men, comrades in many a heroic fight, drew closely together, awaiting calmly the death before them. The hundreds of firemen and guards, desperate in their helplessness, could do nothing; no power could save them. It was a heart-breaking scene as they clasped hands in their last farewell. The flames, fanned by the brisk east wind, swept about their forms, which were clearly outlined against the glaring whiteness of the tower, and man by man they dropped in full sight of the agonized throng below. While one or two yet remained the great tower tottered and fell, crashing through the roof and carrying with it the unconscious men. Captain Fitzpatrick, who had been connected with the fire department of the Exposition since its organization, was one of the first to fall. Fatally hurt, he was found by Marshal Murphy just as there came a great upheaval of the main roof, caused by an explosion beneath; he was still alive, but was cut off from aid by a great volume of fire. Hastily descending to the ground, Murphy ordered a ladder placed against the trembling wall at a point where Fitzpatrick could be reached, and called for volunteers to attempt the rescue. It was a call to battle hand to hand with death, yet three men stepped forth, and this heroic quartette, with the marshal in advance, mounted the insecure ladder, disappearing in the flames. Few dared hope for their return. Presently, however, they reappeared, bearing the helpless man, and carefully lowered him from the wavering cornice; this done, they had scarcely reached the ground, three by means of the ladder, the fourth by sliding ninety feet down a line of

BURNING OF COLD STORAGE HOUSE AT THE WORLD'S FAIR—SHOWING THE BUILDING SOON AFTER THE FALL OF THE SMOKE STACK TOWER.

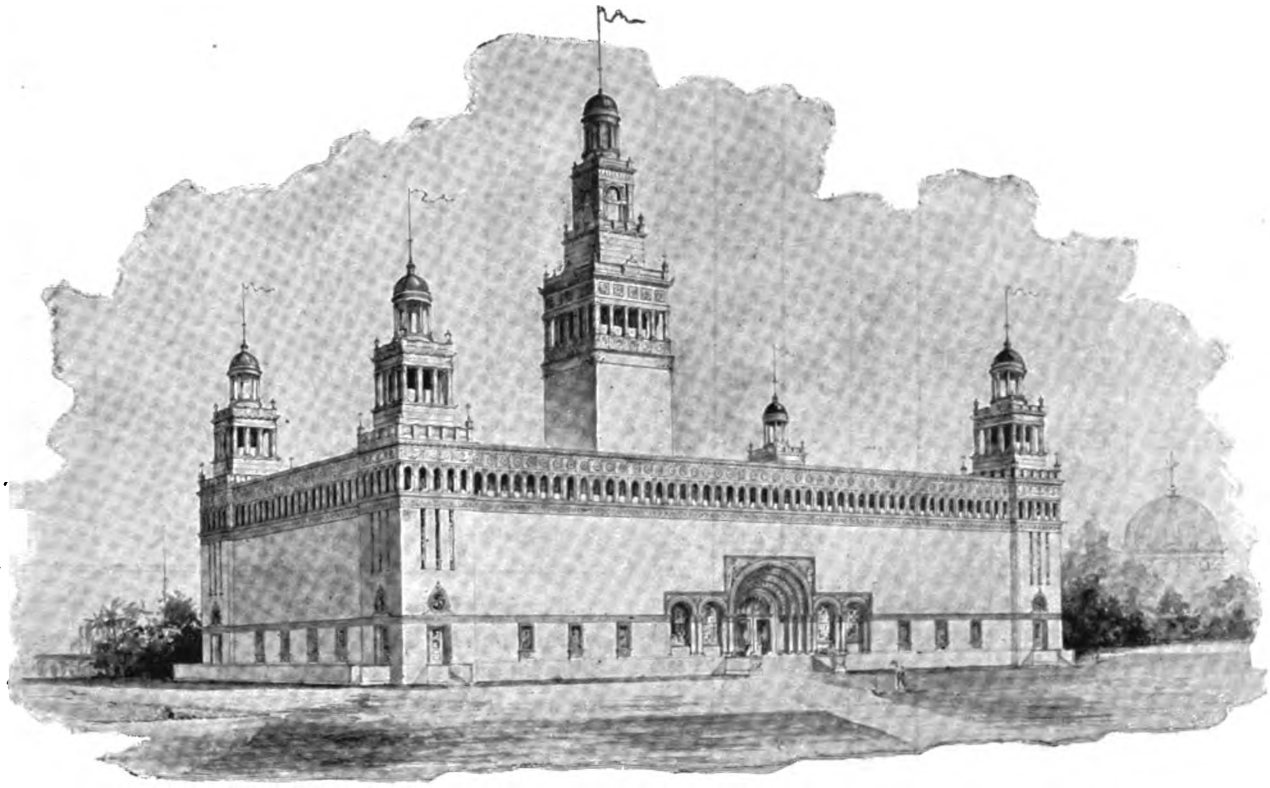
hose, when the entire wall fell in. It was a gallant effort to rescue the brave Fitzpatrick, who died from his injuries in a few hours. Sixteen men, eleven of whom were members of the fire department, are known to have perished. Besides these some fifteen were injured. Within one hour, so fierce were the flames, the entire building was consumed."

Our illustrations show the doomed building at the moment the flames burst from the tower and roof under the firemen imprisoned on the fatal tower; while the larger picture shows the condition of the building soon after the tower had fallen in, which occurred some thirty or more minutes after the alarm of fire was given.

It is not our province to discuss the details of this great calamity; all these will appear later, perhaps, since Mr. D. H. Burnham, director of works of the Columbian Exposition, Fire Marshal Murphy and Messrs. Skinner and MacDonald, of the Hercules Iron Works, have been held by the coroner's jury to await the action of the grand jury and a legal trial to fix the responsibility for the loss of life. Mr. F. P. Burnham, the architect, was, by the coroner's jury, exonerated from all responsibility in connection with the fire, his plans having been approved by the construction department of the World's Fair, and he himself having taken no part in the erection of the building, beyond the preparation of the plans and specifications therefor.

On July 12, the Hercules Iron Works, who had lost some $250,000 by the fire, with practically no insurance, made an assignment in the county court for the benefit of their creditors. The liabilities stated are somewhat in excess of $250,000, with claimed assets of the works and personal assets of Messrs. Skinner and MacDonald of over $500,000. These gentlemen are confident that the affairs of the Hercules Iron Works will be speedily adjusted, when they will resume operations.

——The directors of the Quincy (Ill.) Ice, Produce and Storage Co., June 28, elected J. H. Brown, president; W. W. Benton, vice-president; Joel Benton, treasurer.



HERCULES ICE MAKING AND COLD STORAGE HOUSE AS IT APPEARED JUST BEFORE THE FIRE.

BOOK NOTICES.

A Week at the Fair. Illustrating the wonders of the World's Columbian Exposition. With maps, illustrations, etc. Chicago: Rand, McNally & Co. Sm. 8mo, 268 pp. Cloth and paper.

This is the very latest guide to the World's Fair, and is compiled from special descriptive articles by Director of Works D.H. Burnham, Mrs. Potter Palmer, the Countess of Aberdeen, Mrs. Schuyler Van Rensselaer, W. E. Curtis, Messrs. Adler and Sullivan, L. S. Beman, W. W. Boyington, Henry Ives Cobb, W. J. Edbrooke, Frank W. Grogan, Sophia G. Hayden, Jarvis Hunt, W. L. B. Jenney, Henry Van Brunt, Francis Whitehouse, and other individuals who have been intimately connected with the great works of the Exposition, each of whom treats of that section of the Fair to which each has given special personal attention. The test is comprehensive, but as closely condensed as is consistent with clearness and accuracy, and the work of all has been woven into a complete whole, which affords full, clear, concise, and, above all, the most reliable information upon every subject embraced in its scope, while, even were such desirable, its space is too limited to admit of verbose descriptions or discursive ramblings; the mere dull, dry cataloguing of details has been equally avoided. A close reading of the book will enable any one to post himself thoroughly as to the architecture, size, cost and decorations of all the buildings; the name and description of each statue, fountain, obelisk, etc., with the names and other data of the architects, artists and sculptors who designed them. The cuts are accurate and artistic, as are the ground plans of the floors of buildings and the indexed general map. In almost every instance the artists and sculptors themselves have described the work, and in such clear, forcible style that even the technical terms of their different arts are made plain. All in all, the book is simple, accurate and well edited.

As Others See Us. Penberthy Injector Co., Detroit; 64mo 24 pp. Free on application.

This is the title of a neat little pamphlet containing letters from steam users, steam supply houses, etc., in United States and Canadas, in reference to the injectors made by the company, some of whom have sold and used these goods from four to six years.

——The Crystal Ice Co., Harrisburg, Pa., has been re-organized with the following officers: President, George G. Boyer; secretary, W. S. Corman; treasurer, George Pancake, directors, George G. Boyer, James Russ and William Smith. The company operates under a charter with a capital stock of $100,000. The works have forty-five tons daily capacity.

[*Written for* Ice and Refrigeration.]

SOME PROPERTIES OF AMMONIA.

PROPERTIES OF SATURATED VAPOR OF AMMONIA—TABLE OF PROPERTIES OF AMMONIA—CALCULATING SPECIFIC HEAT BY FORMULA.

By Prof. De Volson Wood.

THE following is the promised corrected and extended table on the properties of the saturated vapor of ammonia:

Temperature.		Pressure, Absolute.							
Degree F. T.	Absolute. t.	Lbs. per sq. ft.	Lbs. per. sq. in.	Heat of Vaporization, Thermal Units. h_e	External Heat, Thermal Units. $\frac{p(v-v_1)}{J}$	Internal Heat, Thermal Units.	Volume of Vapor per lb., cu. ft. v.	Volume of Liquid per lb., cu. ft. v_1.	Weight of a cu. ft. of Vapor, Pounds. $\frac{1}{v}$.
— 40	420.66	1540.9	10.69	579.67	48.23	531.44	24.37	.0234	.0410
— 35	425.66	1773.6	12.31	576.69	48.48	528.21	21.29	.0236	.0467
— 30	430.66	2035.8	14.13	573.69	48.77	524.92	18.66	.0237	.0535
— 25	435.66	2329.5	16.17	570.68	49.06	521.62	16.41	.0238	.0609
— 20	440.66	2657.5	18.45	567.67	49.38	518.29	14.48	.0240	.0690
— 15	445.66	3022.5	20.99	564.64	49.67	514.97	12.81	.0242	.0779
— 10	450.66	3428.0	23.77	561.61	49.99	511.62	11.36	.0243	.0878
— 5	455.66	3877.2	26.93	558.56	50.31	508.25	10.12	.0244	.0988
0	460.66	4373.5	30.37	555.50	50.68	504.82	9.04	.0246	.1109
+ 5	465.66	4920.5	34.17	552.43	50.84	501.59	8.06	.0247	.1241
+ 10	470.66	5522.2	38.55	549.35	51.13	498.22	7.23	.0249	.1384
+ 15	475.66	6182.4	42.93	546.26	51.33	494.93	6.49	.0250	.1540
+ 20	480.66	6905.3	47.95	543.15	51.61	491.54	5.84	.0252	.1712
+ 25	485.66	7695.2	53.43	540.13	51.80	488.23	5.26	.0253	.1901
+ 30	490.66	8556.6	59.41	536.92	52.01	484.91	4.75	.0254	.2105
+ 35	495.66	9493.9	65.93	533.78	52.22	481.56	4.31	.0256	.2320
+ 40	500.66	10512	73.00	530.63	52.42	478.21	3.91	.0257	.2583
+ 45	505.66	11616	80.66	527.47	52.62	474.85	3.56	.0260	.2809
+ 50	510.66	12811	88.96	524.30	52.82	471.48	3.25	.0260	.3109
+ 55	515.66	14102	97.93	521.12	53.01	468.11	2.96	.0260	.3379
+ 60	520.66	15494	107.60	517.93	53.21	464.72	2.70	.0265	.3704
+ 65	525.66	16993	118.03	514.73	53.38	461.35	2.48	.0266	.4034
+ 70	530.66	18605	129.21	511.52	53.57	457.85	2.27	.0268	.4405
+ 75	535.66	20336	141.25	508.29	53.76	454.53	2.08	.0270	.4808
+ 80	540.66	22192	154.11	504.66	53.96	450.70	1.91	.0272	.5262
+ 85	545.66	24178	167.86	501.81	54.15	447.66	1.77	.0273	.5649
+ 90	550.66	26300	182.8	498.11	54.28	443.83	1.64	.0274	.6098
+ 95	555.66	28565	198.37	495.29	54.41	440.88	1.51	.0277	.6622
+ 100	560.66	30980	215.14	491.50	54.54	436.96	1.39	.0279	.7194
+ 105	565.66	33550	232.98	488.72	54.67	434.08	1.289	.0281	.7757
+ 110	570.66	36284	251.97	485.42	54.78	430.64	1.203	.0283	.8312
+ 115	575.66	39188	272.14	482.41	54.91	427.40	1.121	.0285	.8912
+ 120	580.66	42267	293.49	478.79	55.03	423.75	1.041	.0287	.9608
+ 125	585.66	45528	316.16	475.45	55.09	420.39	.9699	.0289	1.0310
+ 130	590.66	48978	340.42	472.11	55.16	416.94	.9051	.0291	1.1048
+ 135	595.66	52626	365.16	468.75	55.22	413.53	.8457	.0293	1.1824
+ 140	600.66	56483	392.22	465.39	55.29	410.09	.7910	.0295	1.2642
+ 145	605.66	60550	420.49	462.01	55.34	406.67	.7408	.0297	1.3497
+ 150	610.66	64833	450.20	458.62	55.39	402.23	.6946	.0299	1.4396
+ 155	615.66	69341	481.54	455.22	55.43	399.79	.6511	.0302	1.5358
+ 160	620.66	74086	514.40	451.81	55.46	396.35	.6128	.0304	1.6318
+ 165	625.66	79071	549.04	448.39	55.48	392.94	.5765	.0306	1.7344

The relations between the pressure and temperature of the saturated vapor have been computed from the formula—

$$Com.\ log.\ p = 8.4079 - \frac{2196}{T}$$

in which p is the pressure per square foot and T the temperature absolute on Fahrenheit scale. If p be per square inch, this becomes—

$$Com.\ log.\ p = 6.2495 - \frac{2196}{T}$$

This is nearly the same as the formula I deduced in my first paper on "Some Properties of Ammonia." The formula then used is—

$$Com.\ log.\ p = 6.2469 - \frac{2200}{T}$$

It may be a satisfaction to know how nearly the results given by this formula agree with those found by the experiments of Regnault, and these are given in the following table which is reprinted from my first paper on this subject:

1. Temperatures in degrees Fahrenheit.	2. Pressure lbs. sq. in. as observed by Regnault.	3. Pressure lbs. sq. in. as calculated from the equation.	4. Numbers in Col. 3 less the corresponding ones in Col. 2.
—24.66	15.80	15.81	+0.01
—24.46	15.96	15.97	+0.01
—23.73	16.25	16.29	+0.04
—17.45	19.43	19.11	—0.32
—17.25	19.51	19.29	—0.22
—14.51	21.26	20.69	—0.57
—14.26	21.66	20.83	—0.83
—11.06	23.01	22.68	—0.43
—8.88	24.12	23.84	—0.28
—8.68	24.26	23.97	—0.29
—1.07	30.32	28.84	—1.48
—1.03	29.33	28.87	—0.46
—0.96	29.43	28.92	—0.51
—0.58	29.65	29.18	—0.47
—0.45	29.55	29.27	—0.28
+1.89	31.30	30.97	—0.33
2.16	31.60	31.15	—0.45
2.89	32.36	31.63	—0.73
7.68	36.20	35.44	—0.76
8.44	36.83	36.07	—0.76
10.13	38.39	37.49	—0.90
13.06	41.35	40.07	—1.28
13.24	41.07	40.24	—0.83
32.00	62.12	60.45	—1.67
39.15	70.07	70.02	—0.05
40.50	73.88	71.96	—1.92
44.47	80.23	77.91	—2.32
45.18	81.39	79.03	—2.36
45.21	81.36	79.07	—2.29
47.21	84.67	82.24	—2.43
49.96	87.20	86.78	—0.42
52.56	93.72	91.26	—2.46
56.34	103.40	98.08	—5.32
57.88	102.76	100.9	—1.86
64.67	118.89	114.6	—4.29
66.72	123.86	118.9	—4.96
67.46	122.44	120.5	—1.94
77.63	148.77	144.5	—4.27
86.88	170.60	169.4	—1.20
90.86	185.46	180.7	—4.76
102.02	217.75	217.3	—0.45
120.07	284.30	287.5	+3.20
131.85	335.93	342.0	+6.07
147.83	418.99	427.94	+8.95
163.98	518.733	530.8	+12.07
179.10	623.47	642.9	+19.43

To more fully elucidate this subject, I refer to my second paper on "Some Properties of Ammonia." [The following is a reprint in full of this paper.—Editor Ice and Refrigeration.]

In my first paper on "Some Properties of Ammonia," I gave a formula, equation (23), for the specific heat of a liquid depending upon the properties of the saturated vapor of the substance. One algebraic sign in that equation should be changed from + to —, so I will here write it correctly:

$$c = \frac{v}{J}\frac{dp}{dt} - \frac{dh_e}{dt} - k_p\left(\frac{dt'}{dt} - 1\right); \quad . \quad . \quad . \quad . \quad . \quad (1)$$

in which

J is the mechanical equivalent of heat, and in English units is 778 foot-pounds.

p, the pressure in pounds per square foot.

v, the volume in cubic feet of a pound of the vapor.

t, the absolute temperature at which the liquid is evaporated.

t', the absolute temperature of the superheated vapor.

T, the temperature on the Fahrenheit scale.

h_e, the latent heat of evaporation per pound in ordinary thermal units; and

k_p, the ordinary specific heat of the vapor, which for ammonia is 0.50836.

In applying this formula, I assumed that $\frac{dt'}{dt}$ was unity, but I find that it has a finite value. I will recompute the value of c, and will bring forward all the necessary formulas.

From the formula

$$\log. p = 8.4079 - \frac{2196}{t}, \quad \ldots \quad (2)$$

we find

$$\frac{dp}{dt} = \frac{2.3026 \times 2196 p}{t^2}, \quad \ldots \quad (3)$$

From the equation

$$p = 91 \frac{t_2}{v_2}\left(\frac{t}{t_2}\right)^{4.3641} - \frac{16920}{v^{1.97}}\left(\frac{t}{t_2}\right)^{6.6274}, \quad \ldots \quad (4)$$

which is the equation of an adiabatic of the superheated vapor; find dt and call it dt', after which drop all the subscripts in the right-hand member, since the initial state must coincide with the general one, and thus find, by the aid of equation (3) above,

$$\frac{dt'}{dt} = \frac{2.3026 \times 2196}{397.13 - \frac{112135}{tv^{0.97}}} \cdot \frac{pv}{t_2} \quad \ldots \quad (5)$$

It was also found that

$$-\frac{dh_e}{dt} = 0.6130 + 0.000438T, \quad \ldots \quad (6)$$

These reduce equation (1) to

$$c = 1.12136 + 0.000438T + \frac{pv}{t_2}\left[6.49922 - \frac{2570}{397.13 - \frac{112135}{tv^{0.97}}}\right] \quad (7)$$

I find that this formula gives a decreasing value of the specific heat for increase of temperature, a condition that has been proved experimentally only for water from 40° F. to about 80° F.; and the decrease was so small as to escape the observation of Regnault, who observed it for states differing considerably in temperature.

Equation (7) gives a decrease of the specific heat of about 0.0014 for each degree of increase of temperature, which is some forty times the positive rate of change of the specific heat of water. The fact that it gives negative results indefinitely, and at so rapid a rate, excites suspicion that the theory is defective. The cause appears to be in the denominator of the last term of the parenthesis of equation (7), for in the determination of the equation to the adiabatic the exponents and coefficients are considered constant, which they cannot be exactly, and the equation of the fluid, $pv = at - \frac{b}{v^n}$, is only approximate. The equation should be used, if at all, only within the limits of Regnault's experiments—that is, between 11 and 24 cubic feet. Using the following set of values, determined in my first paper, viz., $v = 20.7985$, $t = 426.66$, $T = -34°$ F., $p = 1823.7$—equation (7) gives

$$c = 1.093, \quad \ldots \quad (8)$$

We next try the effect of assuming that the adiabatic of the superheated vapor is that of a perfect gas. For this case we have

$$pv = Rt = 89.343t.$$

$$\frac{t}{t_2} = \left(\frac{v_2}{v}\right)^{y-1}, \quad \ldots \quad (9)$$

$$p = R\frac{t_2}{v_2}\left(\frac{t}{t_2}\right)^{\frac{y}{y-1}} \quad \ldots \quad (10)$$

$$\frac{dp}{dt} = \frac{y}{y-1} \cdot \frac{R}{v_2}\left(\frac{t}{t_2}\right)^{\frac{1}{y-1}} \quad \ldots \quad (11)$$

Dropping the subscripts $_2$, and accenting dt, we have

$$\frac{dp}{dt'} = \frac{395.31}{v} \quad \ldots \quad (12)$$

This, with the preceding equations, reduces equation (1)

$$c = 1.12136 + 0.000438T - 0.00202\frac{pv}{t^2} \quad (13)$$

For the state

$$v = 20.7985,\ p = 1823.7,\ t = 426.66,\ T = -34° F.$$

This becomes

$$c = 1.10647 - 0.00042 = 1.10605, \quad \ldots \quad (14)$$

For the state $T = 80°$ Fahr.

$$v = 1.89,\ p = 22192,\ t = 540.$$

we have

$$c = 1.15640 - 0.00029 = 1.15611, \quad \ldots \quad (15)$$

It will be seen that the last term of equation (13) is so small as to affect only the fourth decimal figure, and hence may be omitted, in which case we have

$$c = 1.12136 + 0.000438T, \quad \ldots \quad (16)$$

We are no longer confined to mere theoretical values for the specific heat of liquid ammonia, for Dr. Hans Von Strombeck, chemist for the De La Vergne Refrigerating Co., of New York, in the summer of 1890, found from the mean of eight experiments that the specific heat is

$$c = 1.22876, \quad \ldots \quad (17)$$

the temperature of the liquid being about 80° F. The specific heat of liquids is, in practice, treated as constant. The value in equation (15) is nearly 6 per cent less than the value found by experiment.

Dr. Strombeck also found the latent heat of vaporization of ammonia at 62.62° F., the mean of six experiments giving

$$h_e = 532.8, \quad \ldots \quad (18)$$

The corresponding value in my table of the properties of saturated vapor of ammonia, in my first paper is

$$h_e = 516.0,$$

which is only 3 per cent less than the value found by Dr. Strombeck.

As will be seen from the above, I found the value, theoretically, of the specific heat of liquid ammonia to be 1.556+ at 80° F., and that Dr. Von Strombeck found the value, experimentally, to be

1.2287+

being the mean of eight experiments.

Another test of my work is in the value of the latent heat of evaporation.

At 32.45° F. my table gives....................	h = 535.18
At 32.45° F. Dr. Strombeck found............	534.2
Difference..............................	0.98
At 53° F. my table gives......................	h_e = 522.39
At 53° Regnault's experiment gives...........	521.64
Difference..............................	0.75

This particular value of Regnault's experiments was determined by Prof. Jacobus from data published by Regnault. Professor Jacobus' work is published in the Transactions of the American Society of Mechanical Engineers. It will be seen that my table gives values practically exact as compared with the two experiments at 32.45° and 53°, and must inspire a certain amount of confidence in the entire table. In my first paper I showed that Ledoux' values for the latent heat of vaporization were certainly too large, though probably only about 4 per cent too large.

[*Adapted for* ICE AND REFRIGERATION.]

MAXWELL'S LITTLE DEMONS.

AN ALLEGED EXCEPTION TO THE SECOND LAW OF THERMODYNAMICS—ARE MAXWELL'S LITTLE DEMONS A REALITY?

ACCORDING to the prevailing conception the body of a gas is made up of small atoms, or molecules, which are in constant motion. The velocity of these motions in connection with the mass of the moving molecules represents the pressure and the temperature of the gaseous body. It is not supposed, however, that all atoms or molecules move with the same velocity; on the contrary, some move faster, others slower; and the direction and velocity of the motions of each molecule are changed quite frequently. The pressure and temperature of a given volume of a gaseous body, therefore, represents the average condition of all these various velocities and directions.

We know from experience that it is impossible to produce any inequality of temperature or pressure within such a body of gas, if it is so enclosed as to permit neither change of volume nor passage of heat, without the application of work or energy. Indeed, this is one expression for the second law of thermodynamics, and it is perfectly consistent with the above conception of a gaseous body as long as we can deal with the same only in mass, and have no power of perceiving or handling the separate molecules of which they are made up; but if we conceive a being whose faculties are so sharpened that he can follow every molecule in its course, such a being, whose attributes are still as essentially finite as our own, would be able to do what is at present impossible to us.

Maxwell was the first to make this observation, and the beings referred to have hence been called "Maxwell's little demons," and under that name are frequently referred to in thermodynamic literature in a kind of derisive way, as of an entirely visionary and hypothetical character. Maxwell, in elucidating the functions of these beings, refers to the above mentioned condition of the molecules in a vessel full of air at uniform temperature; accordingly these molecules are moving with velocities by no means uniform, though the mean velocity of any great number of them, arbitrarily selected, is almost exactly uniform. Now, let us suppose, says Maxwell, "that such a vessel is divided in two portions, *A* and *B*, by a division in which there is a small hole, and that a being who can see the individual molecules opens and closes this hole, so as to allow only the swifter molecules to pass from *A* to *B* and only the slower ones to pass from *B* to *A*. He will thus, without expenditure of work, raise the temperature of *B* and lower that of *A* in contradiction to the second law of thermodynamics. This is only one of the instances in which conclusions which we have drawn from our experience of bodies consisting of an immense number of molecules may be found not to be applicable to the more delicate observations and experiments which we may suppose made by one who can perceive and handle the individual molecules which we deal with only in large mass."

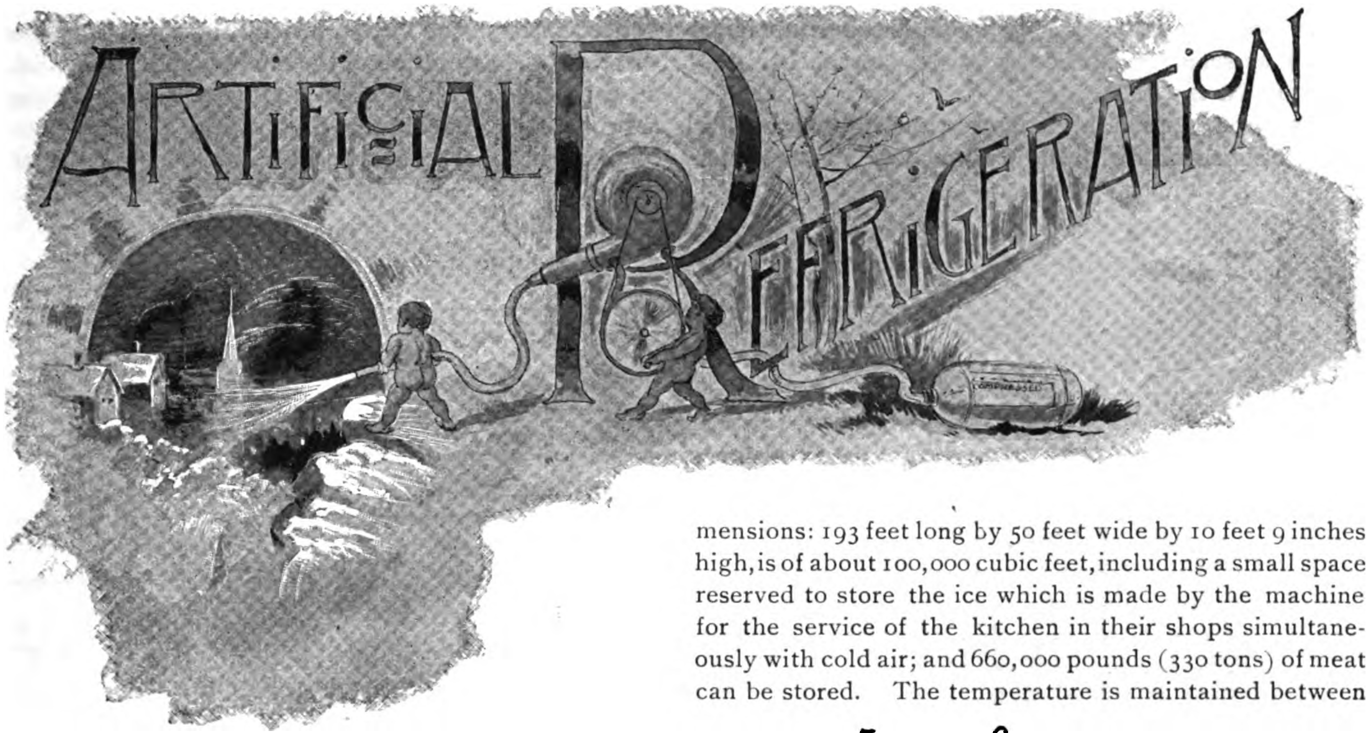
"Truth is stranger than fiction," and indeed, if the conjectures of Mr. Stoney as given in a recent issue of the proceedings of the Dublin Society are correct, there are certain bacilli which even discount the little demons of Maxwell. These bacilli, *e. g.*, some of the nitrifying bacilli of the soil, are said to be sustained by purely mineral food, while they furnish ejecta which contain as much potential energy as their food, or more. If this be the case, they must be supplied with a considerable amount of energy to enable them to evolve protoplasm and the other organic compounds of which they consist, from these materials. Now, many bacilli are so situated that this energy is certainly not derived from sunshine, and it is suggested that it may be derived from the gases or liquids about them.

The average speed with which the molecules of air dart about is known to be nearly 500 meters a second—the velocity of a rifle bullet; and the velocity of some of the molecules must be many times this, probably five, six or seven times as swift. We do not know so much about the velocities of the molecules in liquids as of those in gases, but the phenomena of evaporation and some others indicate that they are, at least occasionally, comparable with those of a gas. Accordingly, whether the microbe derives a part of its oxygen or other nourishment from the gases or from the liquids about it, it is conceivable that only the swifter moving molecules can penetrate the microbe sufficiently far, or from some other cause are either alone or predominantly fitted to be assimilated by it.

Now, if this be what is actually taking place, the adjoining air or liquid must become cooler through the withdrawal from it of its swiftest molecules; and in compensation, an amount of energy exactly equivalent to this loss of heat is imparted to the microbes, and available for the formation within them of organic compounds.

It is further evident that if this be the source of energy upon which bacilli and cocci have to draw, the minuteness of their narrowest dimension will be of advantage—probably essential to them. Presumably it would be limited only by such other necessary conditions as may forbid the diminution of size being carried beyond a certain point. The diameter of a bacillus is frequently as small as half or a third of a micron, which brings it tolerably well into the neighborhood of some molecular magnitudes.

The transference of energy here suggested may be what occurs, notwithstanding that it does not comply with the second law of thermodynamics, which states that heat will not pass from a cooler to a warmer body unless some adequate compensating event occurs, or has occurred, in connection with the transference. This law represents what happens when the vast number of molecular events (which are the real events of nature) admit of being treated statistically, and furnish an average result. It, therefore, has its limits; and the communication of energy from air to minute organisms, which is described above, is an example of a process which is exempt from its operation, since this treatment is supposed to be brought about by a discriminating treatment of the molecules that impinge upon the bacillus, of precisely the same kind as that which Maxwell pictured as made by his little demons. It, therefore, belongs to the recognized exception to the second law of thermodynamics, viz., that which occurs in the few cases in which we can have under observation the special consequences of selected molecular events, instead of, as on all ordinary occasions, being able to measure an average outcome only from all the molecular events in the portion of matter we are examining.



[*Written for* ICE AND REFRIGERATION.]

CONSERVATION OF MEATS.

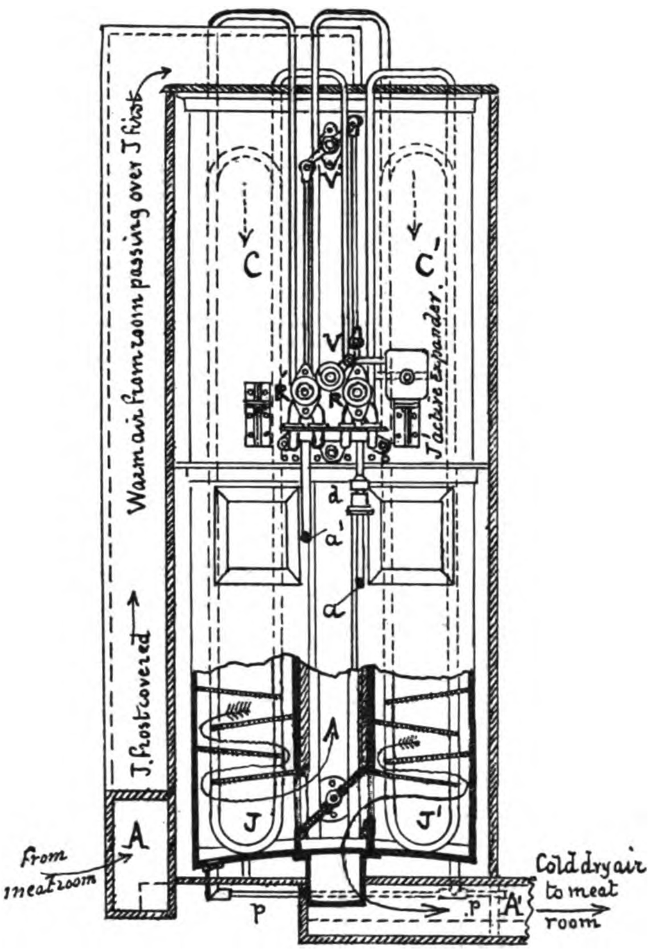
PRESERVING FRESH MEATS AS INVESTIGATED ON THE CONTINENT OF EUROPE—INSTALLATIONS OF COLD STORAGES IN GERMANY—THE CREFELD ABATTOIRS.

BY AUGUSTE J. ROSSI, B. S., C. E.

[*Continued from July number, page 15.*]

THE cold storage establishment at the abattoir of Crefeld (Germany) can be quoted as a good model of the third type. It appears, according to German papers, that the system has been adopted by the "Municipality" after a competition in which have taken part eleven different builders of refrigerating machines and cold storages. The results are stated to have been as satisfactory as could be desired. The figures give the details of the different dispositions adopted, of which we will epitomize the principal. There are no coils of pipes on the ceiling of the meat room. The air, previously cooled and dried, and having deposited its moisture and such other impurities as it may have charged itself with on the cold metallic surfaces of the "air cooler," to be described further, and established in a room absolutely distinct from and having no communication with the meat room, is discharged in the latter by the action of a blower *V* (Figs. 1 and 2). It charges itself with watery vapors at the expense of the tissues, and, having been warmed up by its contact with and circulation around the meats, is exhausted by the same blower which forces it through the cooling apparatus and returns it cold and dry to the room. The hoar frost condensed on the surface of the pipes of the cooler can be removed, whenever it has accumulated to a certain extent, without stopping the machine or its cooling action. The "air cooler," as we will see, is, in fact, the refrigerator of the ice machine itself; it contains the volatile liquid, liquefied ammonia in this case, the direct expansion of which produces the cold which is directly transmitted to the air by contact with the surface of the coil pipes of this cooling apparatus, no intermediary agent, like the brine of the first types, being resorted to to obtain this effect. The capacity of the meat room, which has the following dimensions: 193 feet long by 50 feet wide by 10 feet 9 inches high, is of about 100,000 cubic feet, including a small space reserved to store the ice which is made by the machine for the service of the kitchen in their shops simultaneously with cold air; and 660,000 pounds (330 tons) of meat can be stored. The temperature is maintained between

FIXARY SYSTEM
Air cooler.



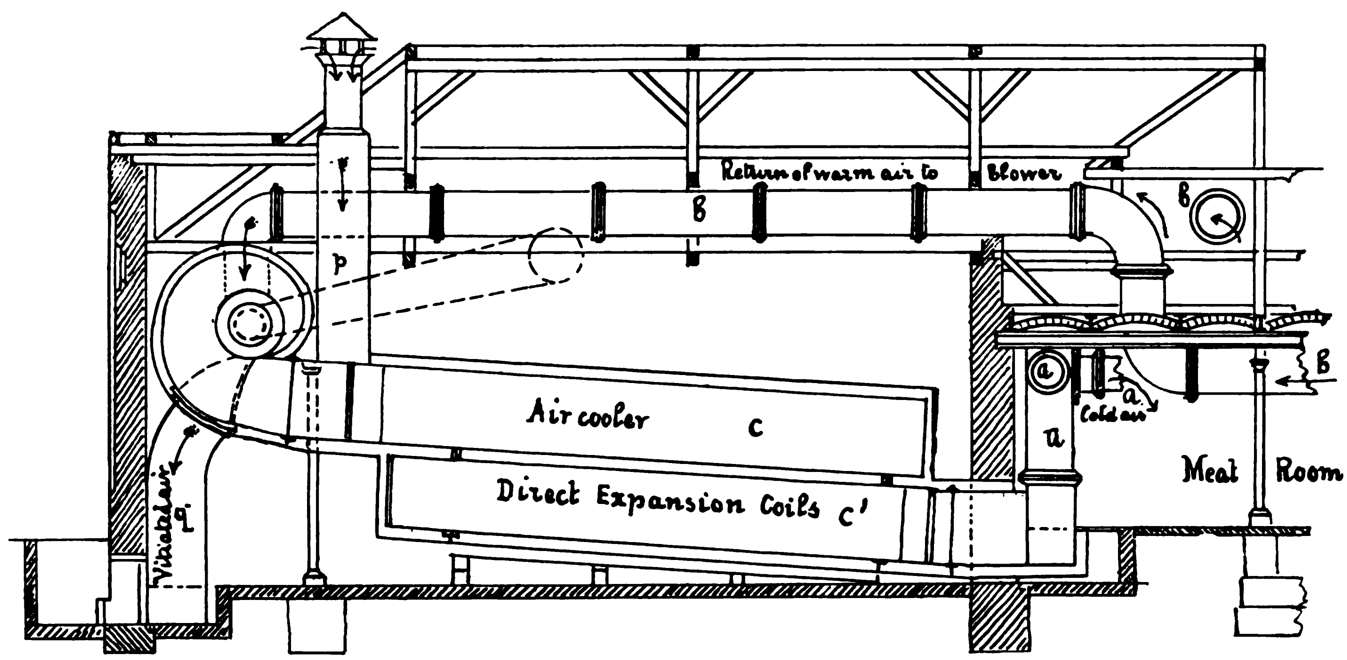
Type No 3.
Fig 5

2° and 4° C. (35° to 37° F. or thereabout). The storage room is divided into stalls or compartments of different sizes; the smallest have the following dimensions: 4½×4½ feet, the next 4½×7 feet, the largest 4½×9 feet (Figs. 3 and 4). They are provided with hooks and such other devices as are necessary for the hanging of meats, and are rented to the butchers by the year. Certain

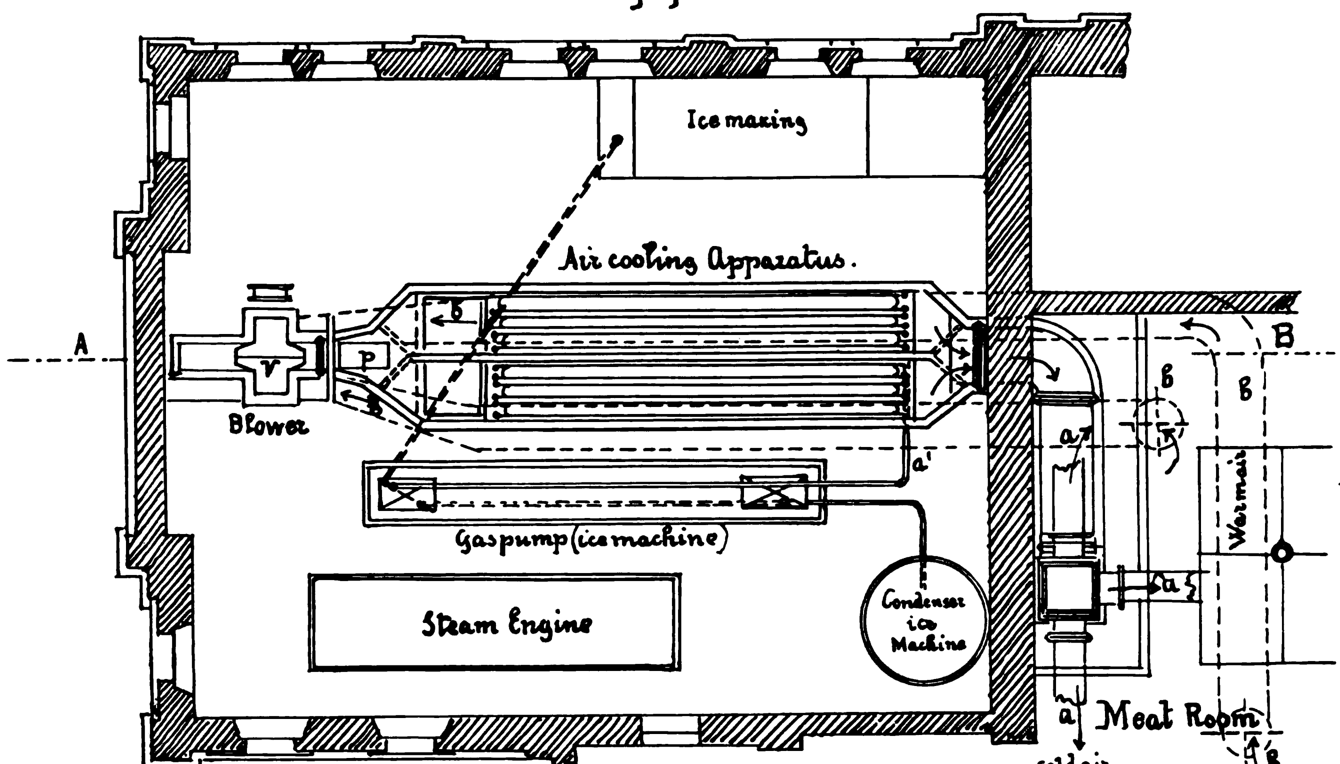
hours are stipulated during which the meats can be stored or removed, no access to the storage being allowed in the intervals.

As it can be seen in the figures, the air blower *V* is in close connection with the "air cooler," its aspiration causing the warm air of the meat room to pass through the cooler before it can be discharged again, dried and cooled, in the room. Whenever it is judged necessary to introduce fresh air from the outside for purposes of ventilation or any other, it can be supplied to any extent desired through the flue *P*, which can be put in connection with the aspiration of the blower, and any vitiated air can be evacuated by pipe *G* (Fig. 1.). The discharging pipe *A A* of the blower (Figs. 1, 2, 3, 4) has a diameter of 2 feet 8 inches, about; the exhausting pipe *C C* of 3 feet, nearly. The ice and refrigerating machine has a capacity of 34,000 thermal units per hour. Besides cooling the air it produces 825 pounds of ice per hour.

1.fig. Section By AB.



CREFELD COLD STORAGE
Type No3. System Fixary. General dispositions of Air Cooler and pipes



Plan. Fig2.

The "air cooler" is of a peculiar construction. It was invented by Mr. Fixary, and is used not only in

this storage but in those of Lisbon, Brussels, Cologne and many others. The Fixary arrangement may be properly called an "Exchanger of Temperatures." It acts very much like what is called a "Regenerator" in a heat engine, the very formation of the last being taken advantage of to produce the useful results. As we have already said, it applies to systems of cold-making in which the volatile liquid is directly expanded in coils, or any other contrivance, without the intermediary of brine.

The apparatus consists essentially of the coils *J*, *J'* (Fig. 5), which are enclosed in the compartments *C*, *C'* of a wooden box *B*, perfectly insulated. These coils are made to communicate alternately with the aspiration of the gas pump of the ice machine by means of proper pipes and devices. For instance, the coil *J'* being in operation, the volatile liquid—liquefied gas ammonia, for instance—is admitted by the pipe *A* through the expanding valve *d* in this coil *J'*, the cocks *R*, *R'* being so disposed and arranged that the opening of one or the other directs the liquid in one coil or the other. The volatile liquid, the liquefied ammonia in this case, expanded and, by this expansion, having produced cold, returns to the pump as gas (Fig. 2) by the pipe *A'* to be compressed and liquefied again by cooling in the condenser, as is usual in this class of mechanical compression machines. The warm air, exhausted or aspirated from the meat room by the blower, is discharged in the air cooling apparatus in *A* (Fig. 5), traverses the compartment *C* from top to bottom around the inactive coil *J*, previously covered with frost by a freezing operation, then enters the compartment *C'*, toward which it is directed by the action of the valves *V* and *V'*, and then returns to the room through *A'* after having been cooled by its passage around the active coil *J'*, on the surface of which its moisture is deposited as frost. When this coil *J* is covered with frost, the position of the cocks *R*, *R'* and of the valves *V* and *V'* is simultaneously reversed, the closing of *R* and opening of *R'* making of *J* the active coil and of *J'* the inactive one; but by the change in the valves *V* and *V'*, the warm current of air from the rooms is directed first from *A* to *C'* in which it circulates around the now inactive but frost covered coil *J'* from top to bottom, passing then into *C*, around the now active coil *J*, to be then further cooled before it returns finally through *A'* to the meat room. When this coil *J* is, in its turn, covered with frost, things are brought back to their original state, and so on. In this manner, the warm air from the rooms is first brought in contact with the inactive frost covered coil, thus covered by a preceding operation; it begins to cool there by melting the frost of the coil, being further and more completely cooled by its passage around the active coil, of which the surface is free from frost, the water resulting from the thawing out of the frost being evacuated by the purging cocks *p*. By this disposition, as it can be seen, the frost formed on the cold metallic surface by the condensation of the moisture of the air is taken advantage of to cool and deprive of moisture, to a certain extent, a fresh quantity of air. The air is in continuous circulation; its velocity is small, and it is thoroughly dried, cooled and purified outside of the meat room before it returns to it. In fact, the "air cooler" is, so to speak, a "double expander," one-half of which only is in operation at a time, the other getting ready to be utilized by its frost being thawed out.*

In cases when the temperature of the air should

Fig3. Longitudinal Section

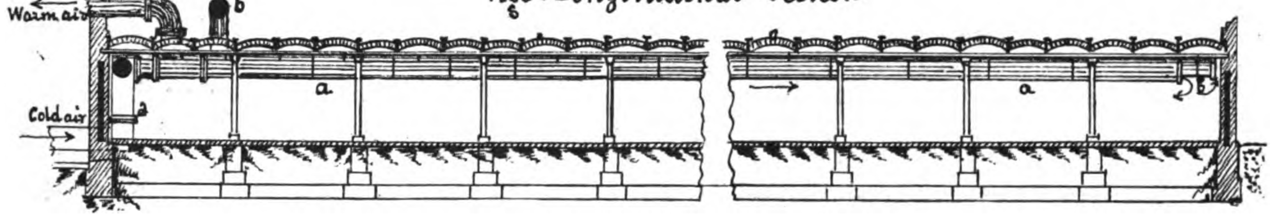
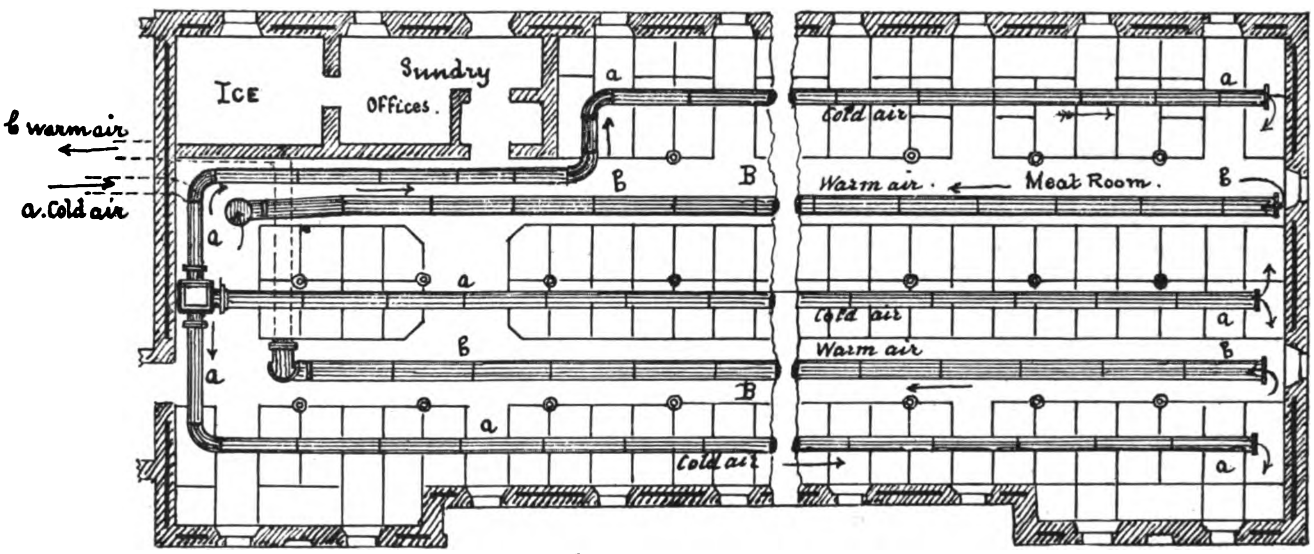


Fig. 4 Plan of meat room.



CREFELD COLD STORAGE

General dispositions of meat room & air circulation

* See E. Fixary's patent, No. 330,884, November 24, 1885.

have to be *below* the freezing point, that is, were the meats to be congealed, or for some other applications, it is obvious that the thawing out of the frost on the coil, which has been active, could not be obtained by passing the returning air from the rooms around it. In this case, the thawing out is secured by suppressing *completely* the circulation of the air around the frost covered coil by the closing of proper valves, and directing it around the other coil, made then the active coil, while the working of proper cocks admits *in the snow covered coil* a certain amount of *hot compressed gas* as it escapes from the pump in its way to the condenser of the machine. In this case, of course, the cold which has produced the frost is lost, but the surfaces are kept clean. Temperatures of air of —12°C. (10° to 11° F.) have been readily obtained in Germany, it is claimed, by this method.

The experiments made by the syndicate of the Paris butchers, by the butchers of Brussels and Cologne, the extensive and detailed official reports which they have published on this question, have proved, they claim, that by this system it has been possible "to preserve for many weeks meats and other perishable articles without freezing them, a practice which deteriorates the fibers and destroys, to quite an extent, the nutritious palatable qualities of meats"—"that, in case temperatures below freezing point are required, this system gives equally satisfactory results."

Resume.—We have come to the end of this rapid examination. We can sum up as follows:

None of the installations described can, in any manner, compare as to importance with the immense cold storage and packing houses of this country. They are more particularly intended for the daily wants of a comparatively small population, or a portion of a large one. However, certain principles and practices seem to have been followed very uniformly, and that, too, in France as well as in Belgium, Portugal and Germany, and to have given very satisfactory results which cannot be ignored, as they have been vouchsafed by hypercritical authorities.

First, Air is the constant vehicle of cold resorted to. *Second,* Air thoroughly *dried* and *cold* is the ultimate agent of conservation, its temperature being confined within a few degrees *above* the freezing point. *Third,* There is no piping in the meat room. The air may be cooled by different contrivances, but it is invariably cooled in *special rooms, distinct* from the meat room. *Fourth,* The *circulation* of the air is considered an essential feature. It is obtained either naturally by the difference in the specific gravity of the air at different temperatures or artificially by means of a blower, but, in all cases, the velocity of the current is very small.

We see also, that, without an exception, the practice recommended by Tellier is followed. The lowering of temperature of the air does not reach below 30° F. It seems to be a confirmed opinion of the continental engineers that meats should not be frozen. In fact, the conditions of the installation do not seem to require the congelation. The meats, at least in all the examples we have quoted, are brought on foot to the abattoirs; they are there slaughtered and removed to the cold storage a few hours after, or, at any rate, they are not intended for transportation at a long distance after slaughtering, and the time during which they have to be preserved is limited to the wants of a market, one week at the most. It is certain, at all events much safer and satisfactory, that, within these limits and in such conditions it will be always preferable and cheaper and safer in order to insure to the preserved meats all the merchantable and palatable quality of fresh meats, not to carry the cooling to the point of congelation. As to the mode adopted to cool the air, the use of a cold brine spray (Schroeder system, first type) has certainly some advantage, as avoiding the formation of frost of the other methods; but it is certainly more cumbrous, it requires much more room and to a certain extent it goes against its object, which is to obtain *dry air.* There is likely to be some danger of the air charging itself with saline particles in solution mechanically carried by the current of air. The system is not as clean and neat as when the air is cooled by its contact with cold metallic surfaces. It is true that the condensation of the moisture, as frost, on these surfaces has the disadvantage of diminishing the conductibility of *cold* from the cold producing agent to the air; but if we adopt "*in toto*" the statements of certain continental engineers, the use of very effective devices can obviate this inconvenience.

It is one which is not so serious, if we consider the comparatively high temperature of the air, which it is not intended to underreach. Undoubtedly, the pipe system in the rooms, as practiced in breweries and cold storages here and elsewhere, admits of a greater extension of application on a larger scale, the room is better utilized, and, for that matter, the air of the rooms is fully as dry and pure as with other dispositions more cumbrous and expensive. Let the volatile liquid be expanded directly in the pipes of the cellar, or let cold brine be circulated in their interior; it is always possible to regulate the temperature, at pleasure, by speeding or slacking the refrigerating machine. Air can just as well be renewed, if desired, by the opening of proper ventilating flues. The objections of the condensation of the moisture as hoar frost on the cold pipes, condensation which certainly taxes unduly the production of the machine, is the only one to be considered in the case, it seems to us. It remains for whatever it may be worth on the point of economy. The practice of freezing the meats, however, is far from being absolutely condemned in Europe. In the "Official Report" which we have quoted, in France, it is at least advised strongly, if not absolutely recommended, whenever meats will have to undergo a transportation involving many days or weeks after slaughtering. When once congealed, meats should be kept in that state, their thawing out at any time (excepting for the purpose of salting) being likely to produce a deterioriation of the quality. If such practice is resorted to the meat should be completely frozen throughout. This freezing of the meats, and their subsequent thawing out, if properly, gradually and carefully conducted by experienced hands, will not practically change their nutritious, and but slightly, if at all, their merchantable qualities. We have seen stated in the report mentioned that sheep transported from La Plata in this frozen state had been sold in Paris like fresh meat. As regards beef carcasses the difficulty appears to be in their size. Even if success has been, or can be, obtained otherwise, the recommendations of the commission, however, must not be disregarded. The dressing and quartering of the larger meats in pieces not very voluminous, though it may necessitate more

room to store them, is certainly logical and well calculated to insure success in freezing and thawing out the meats; and in this respect not much exception can be taken. On another hand, frozen meat can be packed much closer, and on this ground there is certainly a compensation.

The report of this "Official Commission," as we have said, covers the careful investigations of professional and technical men; it is the result of a protracted and critical examination, continued for over a year, of all that has been done in this line; no individual interests were at stake. It contemplates, eventually, the establishment of cold storages on an immense scale, sufficient to provide for the wants of nearly 3,000,000 of men in ordinary circumstances, and for special emergencies. As such, we might accept its conclusions.

First.—Whenever meat is to be preserved for a comparatively short time, for market purposes, the animals being slaughtered close to the cold storage or not having to be transported, after slaughtering, for a distance involving more than a few hours (as much as twelve), in transit, the congelation is not required to insure the conservation. It should be avoided as, by such a practice, that is, the temperature being kept in the storage above the freezing point, the meats *are sure* to retain all their palatable and merchantable qualities.

Second.—In special circumstances, such as for a protracted conservation, in case of a transportation of the slaughtered animals from very long distances, involving days or weeks in transit, congelation appears to be preferable and safer. It does not *necessarily* render the meats less merchantable, wholesome or palatable, if they are frozen and thawed out, very slowly, gradually and carefully; and only after they have been deprived *partially* of the excess of moisture of their tissues.

Third.—Cold, dry air should be the vehicle of cold; it should circulate freely around the meats.

FROZEN BLOOD.

DR. W. H. NEALE, who was medical officer to Mr. Leigh Smith, in his two expeditions to the Arctic regions in 1880 and 1881–92, gave recently in the London *Times* some interesting facts in relation to the feeding of the men after the vessel they were in had been crushed by the ice and sunk at Cape Flora, in August, 1881. The twenty-five in the party rescued from the ship four boats and bedding and canned provisions for two to three months. Yet they were not less than twelve months from any chance of rescue.

"However," says Dr. Neal, "everything turned out well. Within two weeks of losing our ship we had built a hut with stones and turf, and covered it with sails; in this twenty-five of us lived for ten months, without any case of illness appearing among us, after which we spent six weeks in our boats, getting to Nova Zembla, where we met the Hope, which had been sent out to look for us under the command of Sir Allen Young. When I state that we had no lime juice, very few tinned vegetables, and very little flour, most people will be surprised that we all returned home, and never had a case of scurvy or sickness break out after the loss of the ship.

"This clean bill of health was, in my opinion, entirely due to our being compelled to live on the food we were able to obtain by shooting the animals of the country. During the year we consumed thirty-six polar bears, twenty-nine walrus, and over 2,000 loons. Every animal we shot we carefully bled before it was cut up, and every drop of blood we could save was kept in tins or pails. This blood was frozen within fifteen minutes of its being obtained, and it was kept frozen until we wanted it for use; every day, if possible, about one pound of blood was put into the soup, and by this means we had a daily supply of fresh blood. When I say fresh blood, I maintain that blood, frozen before it has time to coagulate, retains all the properties of blood just drawn from a live animal; and if you can keep men on this food during the winter, you will not know what scurvy is. If, on the other hand, we had saved enough tinned meats to last us through the winter, we should never have managed to make the crew eat fresh meat, and scurvy would have thinned our numbers long before the summer came. Only those who have been in the Arctic regions can know how a crew composed of whalers will do all they can to obtain tinned meats, and refuse bear or walrus as long as they can have anything else to eat."

ACTION OF LOW TEMPERATURES.

FROM the results, recently published, of some investigations carried out by Pictet on the effect of low temperatures on chemical action, it would seem that there is a limiting temperature below which chemical affinity is not operative, says the *Scientific American.* Just as, at the other end of the scale, chemical compounds are broken up, their union being dissolved through the operation of dissociation, so, when the temperature falls below a certain point, substances which ordinarily evince a powerful affinity for each other become entirely inactive. From theoretical considerations he had deduced the conclusion that chemical action should be impossible under these conditions, and his experiments show this to be the case. For example, slightly diluted sulphuric acid, solidifying at —56°, was intimately mixed at —125° with finely powdered caustic soda, and the mixture strongly compressed, but there was no sign of chemical action. On allowing the temperature to rise to —80°, action suddenly commenced, and became so violent that the containing vessel was broken. Similar results were obtained with sulphuric acid and potash. Concentrated ammonia solution and sulphuric acid are without action on one another at —80°, but complete action suddenly sets in at from —60° to —65°. Common salt and sulphuric acid do not react at —50°, nor is there much action until the temperature reaches —25°. Moderately dilute sulphuric acid does not attack carbonates at —80°. Bubbles of gas begin to appear between —60° and —50°, but brisk effervescence does not set in until the temperature has reached —30° or upward. Similar results were obtained with nitric in place of sulphuric acid, but the temperature at which action commenced was rather lower in each case. Even the very sensitive vegetable colors are not affected at very low temperatures. Thus the litmus is not reddened by sulphuric or hydrochloric acid at —120°, and alcoholic potash does not give a coloration with phenolphthalein at —135°. From these and similar experiments, Pictet concludes that chemical reaction cannot occur between —125° and — 150°.

[*Adapted for* ICE AND REFRIGERATION.]

REFRIGERATION IN OLDEN TIMES.

HOW SNOW WAS STORED AND USED BY THE ANCIENTS—CURIOUS DISCOURSE CONCERNING THE PHILOSOPHY OF COOLING AND FREEZING OF WATER—HISTORICAL ANECDOTES.

THE following is, if not an instructive, at least a highly interesting account of refrigeration as practiced and utilized in foreign countries in olden times. It is taken from an old German work published some hundred years ago in Goettingen, entitled "History of Inventions and Discoveries, by J. Beckmann":

The art of preserving snow for cooling liquors during the summer, in warm countries, was known in the earliest ages. The practice is mentioned by Solomon, and proofs of it are so numerous in the works of the Greeks and the Romans that it is unnecessary for me to quote them, especially as they have been collected by others. How the repositories for keeping it were constructed, we are not expressly told, but what I know on the subject I shall here lay before the reader.

That the snow was preserved in pits or trenches is asserted by many. When Alexander the Great besieged the city of Petra he caused thirty trenches to be dug and filled, which were covered with oak branches and which kept in that manner for a long time. Plutarch says that a covering of chaff and coarse cloth is sufficient, and at present is pursued in Portugal. Where the snow has been collected in a deep gulf, some grass or green sod covered with dung from the sheep pens is thrown over it, and under these it is so well preserved that the whole summer through it is sent the distance of sixty Spanish miles to Lisbon.

When the ancients therefore wished to have cooling liquors they either drank the melted snow or put some of it in their wine, or they placed jars filled with wine in the snow and suffered it to cool as long as they thought proper. It appears that in these trenches it could not remain long clean; on the contrary, it was generally so full of chaff that the snow water was somewhat colored with it and had a taste of it, and for this reason it was necessary to strain either it or the wine that had been cooled by it.

That ice also was preserved for the like purpose is probable from the testimony of various authors; but it appears not to have been used so much in warm countries as in the northern. Even at present snow is employed in Italy, Spain and Portugal; but in Persia ice. I have never, anywhere, found an account of Grecian or Roman ice houses. By the writers on agriculture they are not mentioned.

Mankind, however, soon conceived the idea of cooling water without snow or ice, from having remarked that it became cold more speedily when it had been previously boiled, or, at least, warmed and then put in a vessel among snow, or in a place much exposed to the air. Pliny seems to give this as an invention of Nero; and a jocular expression in Suetonius makes it, at any rate, probable that he was fond of water cooled by this method; but it appears to be much older. It seems to have been known even to Hippocrates—at least Galen believes so; and Aristotle was undoubtedly acquainted with it, for he says that some were accustomed, when they wished water to become soon cold, to place it first in the sun and suffer it to grow warm. He relates also, that the fishermen near the Black sea poured boiling water over the reeds which they used in fishing on the ice to cause them to freeze sooner. Galen on this subject is still more precise. He informs us that the above practice was not so much used in Italy and Greece, where the snow could be procured, as in Egypt and other warm countries where neither snow nor cool springs were to be found. The water, after it had been boiled, was put into earthen vessels or jars, and exposed in the evening on the upper part of the house to the night air. In the morning these vessels were put into the earth (perhaps in a pit) moistened on the outside with water, and then bound round with fresh or green plants, by which means the water could be preserved cool throughout the whole day. Athenæus, who gives a like account from a book of Protagorides, remarks that the pitchers filled with water, which had become warm by standing all day long in the sun, were kept continually wet during the night by servants destined to that office, and in the morning were bound round with straw. In the island Cimolus, water which had become warm in the daytime was put into earthen jars and deposited in a cool cellar, where it grew as cold as snow. It was generally believed, therefore, that water which had been warmed or boiled was soonest cooled, as well as acquired a greater degree of refrigeration; and on this account boiled water is mentioned so often in the work of the ancients.

The same opinion prevails at present in the southern countries of Asia, and people there still let their water boil before they expose it to the air to cool. The experiments, however, which have been made on this subject by philosophers have proved very different in the results. When one, indeed, places boiling and cold water, all other circumstances being equal, in frosty air, the latter will become ice before the former has cooled; but when one exposes to the cold water that has been boiled and unboiled water of equal temperatures, it may then be expected that the former will be converted into ice somewhat sooner. Water, by being boiled, loses a considerable portion of its air, while that of unboiled water must be disengaged before it can freeze, and by this its particles are kept in continual motion, which may retard its congelation. Boiled water, however, in cooling imbibes air again, but for that purpose seven or eight days are necessary, according to the observation of Mariotte. One might, therefore, conjecture that the Indians are right.

The experiment, however, made by Mariotte, Perrault, the Academy del Cimento, Marian and others, showed no perceptible difference in the time of freezing between boiled and unboiled water; but the former produced ice harder and clearer; the latter more full of blisters. In later times Dr. Black, of Edinburgh, has, from his experiment, asserted the contrary. Boiled water, he says, becomes ice sooner than unboiled if the latter be left at perfect rest; but if the latter be stirred sometimes with a chocolate stick it is converted into ice as soon as the former. This difference he explains in the following manner: Some motion promotes con-

gelation; this arises in the boiled water through its reimbibing air, and, therefore, it must necessarily freeze before the unboiled, provided the latter be kept at perfect rest. Fahrenheit had before remarked that water, not moved, would show a cold some degrees below the freezing point, without becoming ice.

Mr. Lichtenberg, with whom I conversed on these contradictory results, assured me that he was not surprised at this difference in the experiments. The time of congelation is regulated by circumstances with which philosophers are not yet sufficiently acquainted. A certain, but not every, degree of stirring hastens it; so that every icy particle which is formed on the side of the vessel, or which falls from the atmosphere, may convert the water sufficiently cooled into ice instantaneously, and such unavoidable accidents must, where all other circumstances are equal, cause great difference in the period of freezing. A variation, therefore, in the time may be well expected, both because the boiling of the river water expels the aerial acid, and because it produces also a kind of inspissation, and because by both these effects united the water must undergo some changes.

I am inclined to think that the cooling of water in ancient times, of which I have already spoken, is not to be ascribed so much to the boiling as to the jars being kept continually wet, and to the air to which it is exposed. A false opinion therefore seems to have prevailed respecting the cause; and because it was considered to be the boiling, many have not mentioned the real cause, which appeared to them only to afford a trifling assistance, though it has been remarked both by Galen and Athenæus. We know at present that the heat decreases by evaporation or that coldness is produced. A thermometer kept wet in open air falls as long as evaporation continues. With ether of vitriol, and, still better, with that of nitre, which evaporates very rapidly, one can in this manner bring water, even in the middle of summer, to freeze; and Cavallo saw in summer a Fahrenheit's thermometer which stood at 64° fall in two minutes, by means of ether, to 3, that is, to 29° below the freezing point. On this principle depends the art of making artificial ice at Calcutta and other parts of India between 25° 30′ and 23° 30′ of the north latitude where natural ice is never seen. Trenches two feet deep, dug in an open plain, are strewed over with dry straw; and in these are placed small shallow, unglazed, earthen pans, filled with water at sunset. The ice which is produced in them is carried away before sunrise next morning, and conveyed to an ice cellar fifteen feet deep; where it is carefully covered with straw to be preserved from the external heat and air. A great deal, in this process, depends upon the state of the atmosphere. When calm, pure and serene, it is most favorable to the congelation; but when the winds are variable or the weather heavy and cloudy, no ice is formed; and the same is often the case when the nights are raw and cold.

It was once believed that this freezing was occasioned principally by the water having been boiled, but it seems to be owing much rather to evaporation. It is not, however, said that the vessels are kept continually wet on the outside, but that they are unglazed and so porous or little burnt that the water oozes through them, and on that account their exterior surface appears always moist. By vessels of this kind the trouble of wetting is saved.

What has been said respecting the influence of the weather serves, in some measure, to confirm my conjecture. The more it favors evaporation, the ice is not only formed more easily, but it is better; and when evaporation is prevented by the wind or the weather, no ice is produced. The latest accounts how ice is made at Benares say expressly that boiled water is not employed, and that all those vessels, the pores of which are stopped by having been used, do not yield ice so soon or so good. In porcelain vessels none is produced, and this is the case also when the straw is wet.

Another method of cooling also seems to have been known to Plutarch. It consisted in throwing into it small pebbles or plates of lead. The author refers to the testimony of Aristotle, but this circumstance I cannot find in the works of the philosopher which have been preserved.

It seems to be too unintelligible to admit of any opinion being formed upon it, and the explanation given by Plutarch conveys still less information than the proposition itself. This is the case in general with almost all propositions of the ancients. We, indeed, learn from the questions that they were acquainted with many phenomena, but the answers scarcely ever repay the trouble which one must employ in order to understand them. They seldom contain any further illustration, and never a true explanation.

It appears that the practice of cooling liquors at the tables of the great was not usual in any country besides Italy and the neighboring states before the end of the sixteenth century. In the middle of that century there were no ice cellars in France, for when Bellou relates in the account of his travels, in 1553, how snow and ice were preserved at Constantinople throughout the whole summer for the purpose of cooling sherbet, he assures us that the like method might be adopted by his countrymen, because he had found ice cellars in countries warmer than France.

The word glaciere also is not to be met with in the oldest dictionaries; and it does not occur even in that of Monet, printed in 1635. Champier, the physician who attended Francis I when he had a conference with the emperor Charles VI, and Pope Paul III, at Nice, saw Spaniards and Italians put snow, which they caused to be brought from the neighboring mountains, into their wine in order to cool it. That practice, which excited his astonishment, he declared to be unhealthful, and this proves that in his time it had not been introduced at the French court.

Grand d'Aussy quotes an anecdote, related by Brantome, from which he forms the same conclusion. The dauphin, son of Francis I, being accustomed to drink a great deal of water at table, even when he was overheated, Donna Agnes Beatrix Pacheco, one of the ladies of the court, by way of precaution, sent to Portugal for earthen vessels, which would render the water cooler and more healthful, and from which all the water used at the court of Portugal was drank. As these vessels are still used in Spain and Portugal, where the wine is cooled also with snow, both methods might have been followed in France. I have in my collection of curiosities fragments of these Portuguese vessels; they are made of red bole, are not glazed though they are smooth, and have a faint gloss on the surface like the Etruscan vases. They are so little burnt that one can easily break them with the

teeth, and the bits readily dissolve in the mouth. If water be poured into such vessels it penetrates their substances, so that when in the least stirred, many air bubbles are produced; and it at length oozes entirely through them.

The water that has stood in them acquires a taste which many consider agreeable, and it is probable that it proceeds from the bark of the fir tree, with which, as we read, they are burnt. When the vessels are new they perform their service better; and they must then also have a more pleasant smell. If they really render water cold, or retain it cool, that effect, in my opinion, is to be ascribed to the evaporation. Their similarity to those in which the Indians make ice is very apparent. Toward the end of the sixteenth century, under the reign of Henry III, the use of snow must have been well known at the French court, though it appears that it was considered by the people as a mark of excessive and effeminate luxury. In the witty and severe satire on the voluptuous life of that sovereign and his favorites, known under the title of "L'Isle des Hermaphrodites," a work highly worthy of notice, but which is exceedingly scarce, we find an order of the Hermaphrodites that large quantities of ice and snow should everywhere be preserved, in order that people might cool their liquors with them, even though they might occasion extraordinary maladies, which, it seems, were then apprehended. In the description of an entertainment we are told that snow and ice were placed upon the table before the king, and that he threw some of them in his wine, for the art of cooling it without weakening it was not then known. The same method was practiced even during the whole first quarter of the seventeenth century.

Toward the end of the above century this luxury must have been very common in France. At that period there were a great many who dealt in snow and ice, and this was a free trade which every person might carry on. Government, however, which could never extort from the people money enough to supply the wants of an extravagant court, farmed out, toward the end of the century, a monopoly of these cooling wares. The farmers, therefore, raised the prices from time to time; but the consumption and revenue decreased so much that it was not thought worth while to continue the restriction, and the trade was again rendered free. The price immediately fell, and was never raised afterward but by mild winters or hot summers.

HOW ICE FORMS.

A RECENT writer describes how the process of freezing is carried on in nature's alchemy. By means of two thermometers it is first ascertained that the temperature of the water at the surface and at the bottom is respectively 48° and 45°. A cold wind sweeps over the surface of the water, so that the temperature is speedily reduced to say 44°. By this reduction in temperature it contracts and becomes specifically heavier, sinking and displacing the comparatively light and warm water below, which rises to the surface, because cooled below 44°, and immediately falls, displacing the warmer water at the bottom, which, in turn, rises, gets cooled and falls, its place being again supplied by lighter and warmer water. And so the cooling and sinking processes go on, the upper thermometer always indicating the higher temperature, when suddenly the magic point 39° is reached, when all movement at once ceases. The upper layer of water is still exposed to the cooling influence of the wind, and speedily falls in temperature, but still retains its place. The upper thermometer now shows that the water which surrounds it is being rapidly reduced in temperature, but the lower one remains stationary at 39°.

At this temperature water is heavier than at any other, and there, like a stone, it remains at the bottom, and as it is fully protected from outward influences by the mass of superincumbent water, its temperature remains very much at the same point. The water on the top, however, having nothing to protect it, gets cooler and lighter every moment. Down the thermometer goes to 37°, 35° and 32° and then a slight breeze ripples the surface, and the next moment a thin sheet of ice spreads itself over all. The ice, however, is colder and lighter than the water, so that it floats on the surface and acts as a blanket, protecting the comparatively warm and heavy water below from being cooled. So that even during the severest winter only a comparatively thin superficial layer of ice is usually formed, and the greater part of the water remains unfrozen at the bottom.

A LENS OF ICE.

A FEW years ago, says the "curio" man of an exchange, an English professor caused quite a little excitement among a party of skaters on Serpentine river "by making a lens of ice and lighting his pipe with it. This reminds the writer that this curious experiment was first brought before the public by the great Dr. Scoresby, who, when in the polar regions, to the great astonishment of his companions (who did not understand why the ice did not freeze the solar rays) performed a similar feat. It may also be worthy of remark that Professor Tyndall, when a teacher in the Royal institute, on several occasions set fire to a little heap of powder with rays from an electric arc concentrated by a lens of ice. His explanation was this: Although ice absorbs rays of certain waves of light and is gradually melted thereby, there are other kinds of waves which it does not absorb, and it is these that produce heat at the focus of the bar of light, which passes through the ice. In short, it is wholly a question of the relative motions of the molecules of frozen water and those of the waves of the more penetrating rays of light."

A WELL OF ICE.

THE telegraph from Carthage, Ill., has reported the following phenomenon: Some weeks ago (in March) an underground river was discovered near Augusta, by a farmer who dug a well. The river is still a mystery, and now another mystery has been discovered. On R. D. Mathews' farm, five miles northwest of Augusta, is a well only ten feet deep, which at this date, April 14, is frozen solid. A year ago last winter, which was a remarkably mild one, great difficulty was experienced in keeping it from freezing. Last winter, however, it froze early in the season. The wall of the well is about twelve inches above the surface of the ground, and earth is heaped around it. The water stands about on a level with the surface of the ground. The well is now frozen solid, and shows no signs of thawing. Many good, reputable men vouch for the truth of the story. This frozen well is only about a mile and a quarter northeast of the wonderful well referred to above.

IMPURE ICE QUESTION.

THE EVANSTON CASE—ACTION OF THE AUTHORITIES AT PARIS—REPORT OF THE MASSACHUSETTS STATE BOARD OF HEALTH ON MANUFACTURED ICE.

THE city of Evanston, Ill., a Chicago suburb, has been having its "spell" of the impure ice fever during the past month. It appears there has been in the city quite an epidemic of malarial complaints since warm weather set in; for which the health officer undertook to find a cause. He is reported, in doing so, to have found the coincidence that the majority of those affected by malarial complaints had used ice sold them by one A. T. Connor, who is said to have purchased ice cut in a Wisconsin lake, into which, said the health commissioner, "drained the sewage of a large district, and which was known for this reason to be impure." Mr. Connor was arrested, though the commissioner has stated that it does not appear that Connor was aware of the impurity of his ice. Samples of the ice were submitted to the chemist of the Northwestern university, who reported that the "ice contained over two times the maximum amount of aluminoid ammonium permitted in any city where the health is a subject of consideration. There are records of cases where the smallest amount of aluminoid ammonium of the nature found in Evanston ice has caused an epidemic." Having gone thus far, the case against Mr. Connor was dismissed on the ground that no notice had been served, and that the ordinance was ambiguous. The officer then recommended that the council "act upon this question by drafting a new ordinance, fixing a limit of impurities, to compel all dealers to register and furnish a written certified statement of the surroundings of the place where their supply is cut, and to furnish a chemical analysis of the same."

At the same time Simpson & Co., of the same place, were also arrested, and discharged. An analytical chemist employed by them certified that their ice is absolutely pure.

Thus the tempest in that tea pot comes to an end; "justice is satisfied," and by and by it may, perhaps, be discovered that there are other causes for malarial complaints save ice.

But the experience so near to Chicago has, of course, affected reflexively Chicago, whose chief health officer has felt constrained to remark: "I have no doubt that some of the ice used in this city is not the purest. We ought, of course, to have some one to inspect the ice which is delivered, but we have no one. Right here would come in work for the bacteriological laboratory, which I have asked to have made a part of this department. I think there should be some inspection of ice, though I have no complaints of impure ice being sold here." In other words, when Jones gets a backache, the department ought to have Smith's tongue examined, because, of course, it is possible for Smith to have a bilious attack when Jones has a lumbago.

IN THE villages of Lockland and Wyoming, Ohio, there has been a recent epidemic of diphtheria. The state health officers took the case in hand, and, after a sleuth-like search that would have done credit to a Lecocq, "discovered" that many water closets in Wyoming empty into a sewer that discharges into the west fork of Millcreek, above the village, and the stream makes its way down through the place, and at one point there is an ice house that last winter was filled with the ice. The commissioners suspect that this ice house is "responsible for the disease"; which is as plausible as that two and two make four, only it appeared later that not one of the families affected by the disease had ever used any of the ice from that stream! And thus two and two seem to make five.

THE Berlin police authorities have recently issued a notice to the effect that the investigations of the Royal Board of Health have demonstrated that specimens of natural ice found in Berlin saloons contained certain microbes, whose ability to grow and become dangerous to health was not destroyed by the freezing process, says a foreign exchange. "The breaking out of sudden diseases following the use of drinks cooled by natural ice may as well be charged to germs contained in the ice as the low temperature of the drink itself. The manifesto issued by the Berlin authorities warns people against partaking of food as well, cooled by natural ice in refrigerators, especially milk, which is one of the most favorable agents for attracting microbes and germs, even in ordinary times. The importance of the subject is such that much care should be expended upon it in finding means to overcome the danger, and in cholera epidemics it would be advisable to keep everything well covered even in refrigerators, especially milk and water, fruit, whether cooked or raw, in fact everything that is usually kept in an ice box for preservation."

IN THE city of Paris, according to the Paris edition of the New York *Herald*, the Conseil d'Hygiene has, through the Prefet de Police, ordered that "manufacturers of, or dealers in, alimentary or industrial ice are to be obliged to store their stock in two entirely separate compartments, one to be set aside exclusively for storage of impure ice to be used in trade, and the other for pure ice for domestic use. On the doors of these two compartments are to be placed labels to read as follows: 'Alimentary ice' (to be printed on a white label), and 'Ice not for alimentary use' (on a red label), according to the kind of ice stored in the receptacle. The vehicles to be used in transporting ice shall bear the same marks, according to the kind of ice they carry, and under no circumstances are these vehicles to be used for any other purpose than that for which they are labeled. Retail dealers are also to be required to have two reservoirs, that do not communicate with each other, and set aside for the two distinct sorts of ice; these are also to be labeled in the same way as the storage houses and vehicles. Retail dealers who may be unable to have the two reservoirs shall only be allowed to keep alimentary ice."

THE city counselor of St. Louis, in a recent opinion on the ordinances regulating the sale of ice, holds that the ordinance requires every person bringing ice into the city, no matter from what section of the state or county it comes from, to obtain a permit from the health commissioner before storing it. The application for this permit must be accompanied by a sworn statement of

the time and place where the ice was cut, so that the health commissioner can have it examined if he deems it necessary, and condemn its use for domestic purposes if impure. The penalty for a violation of this law is a fine of from $50 to $250 for each and every offense. The health commissioner has been instructed to see that it is rigidly enforced in the future.

ST. LOUIS is again stirred up by the "pond ice" question, which is assumed, by the newspapers at least, to be impure. The discussion has brought out a review of the local laws on the subject, which are substantially as follows:

Heretofore there was a law prohibiting the cutting of ice on all sloughs and ponds in the city. This was extended later to embrace the River des Peres and other running streams within a radius of ten miles of the city.

Still later an amendment was made to the ordinance which is very important, but which has never been enforced. It requires every person bringing ice into the city, no matter from what section of the state or county it comes, to obtain a permit from the health commissioner before storing it.

The application for this permit must be accompanied by a sworn statement of the time and place where the ice was cut, so that the health commissioner can have it examined, if he deems it necessary, and condemn its use for domestic purposes if impure.

The penalty for a violation of this law is a fine of from $50 to $250 for each and every offense.

The health commissioner has been instructed to see that it is rigidly enforced in the future.

IN ACCORDANCE with an order of the legislature, passed a year ago, the Massachusetts state board of health had its chemist, Prof. T. M. Brown, examine the system by which artificial ice is made in Massachusetts, and determine whether the amount of zinc found is sufficient to injure the health of the people using it. This work was finished some time ago, and was made public July 17. We quote the report entire. Prof. Brown says:

That the fitness of a natural water for freezing must depend on its purity. It would be seldom that even a well water could be found which would not give an objectionable degree of concentration of mineral matter in the portion last frozen.

Although it can be said that the ice from some of the companies would prove injurious, yet water with seventy parts of solids and a hardness equivalent to twenty-one parts per 100,000 of carbonate of lime is certainly not a desirable drinking water for those who are accustomed to a soft water. It was said by this company that they were preparing to use distilled water only.

The free ammonia present in all the samples of ice may fairly be supposed to come from slight leakage of the machine. It is safe to say that, in the absence of other evidence of organic contamination it has no significance.

In many of the samples an appreciable amount of zinc was found. This can only have its origin in the zinc coating of the galvanized pipes used to conduct the water, or in the coating of the tanks in which the water is frozen. The largest amount found was .24 parts of metallic zinc per 100,000, which is equal to 0.14 grain per gallon.

The board concluded that:

First.—Artificial processes of freezing concentrate the impurities of the water in the inner core or the portion last frozen.

Second.—The impurities are reduced to their lowest terms by the use of distilled water (condensed steam) for the manufacture of ice.

Third.—The number of bacteria in artificial ice is insignificant under the prevailing methods of manufacture.

Fourth.—The amount of zinc found in the samples of melted artificial ice under observation is insufficient to injure the health of persons using such ice.

There are three firms in the state that make ice for sale, and all of the corporations use the ammonia system of freezing.

Galvanized iron tanks, holding from 200 to 250 pounds of distilled water, are immersed in lime, which is cooled below the freezing point of water by pipes which convey the gaseous ammonia.

The freezing goes on slowly from the sides of the tanks, and it generally requires about two days to form a solid cake of ice.

The distilled water is generally condensed steam from the engine, which is filtered through various media, such as sand, coke and charcoal, to free it from oil, grease and other suspended matters, and is subsequently boiled to expel air.

Water containing air will give bubbly ice. The more completely the water is freed from air the clearer and more compact the ice will be.

The water in all three plants is obtained from wells sunk on the premises, and all contain considerable mineral matter in solution; but when the water is converted into steam and only the condensed water is used for ice making the original composition of the water is of comparatively little consequence.

Well water is preferred to surface water, for the reason that the latter, on account of the vegetable matter it generally contains, would be likely to communicate an odor to the distilled water from it, and this odor would be noticeable in the ice.

The board some time ago made an investigation upon the pollution of natural ice supplies, and as a result it was shown that, in the progress of slow freezing in lakes and ponds, the elimination of disordered mineral substances was nearly complete. The dissolved organic matter in the water—only 6 per cent—remained in the clear ice formed below the surface.

In the process of making artificial ice it is obvious that the ice block, as a whole, must have identically the same composition as the water from which it is made; but we should expect that in the slow process of freezing, the ice layers first formed would—if the water contained any dissolved impurities—be purer than the original water, and that the impurities would be gradually concentrated in the remaining water. This is found to be the case, and the inevitable result is that the portion of ice last formed contains the impurities of the water in a highly concentrated condition.

In order to show this all of the blocks of ice examined were divided into six portions, and each portion, after melting, was analyzed separately. These portions represented the upper, middle and lower thirds of the outside, and the upper, middle and lower thirds of the inner core. In nearly all cases it was found that the lower third of the core contained the greater part of the impurities originally present in the water.

This is most strongly marked in the case of block ice, which is made from boiled spring water containing a great deal of dissolved mineral matter. In the other two cases, the amount of dissolved matter in the distilled water being very small, the concentration is less noticeable.

It is interesting in this connection to note that the sample of distilled water taken from the rubber hose used to fill the tanks had a faint odor of rubber.

The number of bacteria in all the samples of ice was very small, and in many there were none present.

In the case of the ice, in which by reason of the large amount of water, the segregation of the impurities can be best studied, it is noticed that the lower third of the interior of the block of ice contained a very large amount of mineral matter. This portion when melted was quite turbid, and deposited a heavy white sediment on standing, consisting mainly of silica. The small amount of organic matter present originally in the water is also found here in a more concentrated form, as shown by the albuminoid ammonia and by the oxygen consumed.

This concentration of the impurities of a water in the process of artificial freezing is a matter of great importance, and it is obvious that only pure waters are adapted for the process. Distilled water leaves nothing to be desired in this respect.

THE other day at Honey Grove, Tex., a 12-year-old son of Dr. Morman, while taking in the sights at the ice factory, discovered the frost on the ammonia pipe, and proceeded to lick it off. As soon as his tongue touched the pipe, it stuck, hard and fast, too. His father discovered the situation and proceeded to pour hot water on the ice, but it, of course, froze as soon as it touched the pipe. He then tried his knife, and after cutting his boy's tongue, gave up in despair. The engineer was called, and he cut off the ammonia, and in a short time Leon was set free, a sadder, but wiser youth.

A NEW YORK daily paper has ventured the opinion that the perfecting of the cold storage system is resulting in the destruction of game fish in waters so far from the big cities that sportsmen were once sure of a "catch" in them, when they could afford to take a week off, and go for it. Now Maine, Florida and Oregon are being swept by the commercial fisherman, with his deadly seine net for the New York daily market. This is bad, of course, to send sportsmen such long distances "for a fish." But isn't it just possible that the craze of sportsmen for "big strings," which they cannot possibly utilize, except for a "fish story," is also doing its "deadly" work. It is so in Illinois and Wisconsin waters; why not in eastern streams also? Everything is a scapegoat in game and fish literature except the "sportsman."

ICE & REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION, THE TEXAS ICE MANUFACTURERS ASSOCIATION AND THE FLORIDA ICE MANUFACTURERS ASSOCIATION.

.·. AUGUST, 1893 .·.

RATES OF SUBSCRIPTION.

IN ADVANCE, POSTAGE PREPAID.

United States, Canada and Mexico, - - - - $2.00 a Year
All other Countries, - - - - - - - - 3.00 "

Single copies 25 cents. Advertising rates on application to the offices. Remittances must be made by post-office orders, postal notes, international money orders, checks or drafts on New York, Chicago or London, payable to H. S. RICH & Co.

H. S. RICH S. P. FOWLER J. F. NICKERSON JNO. GLENN COLLINS

H. S. RICH & CO.

PUBLISHERS,

177 La Salle St., Cor. Monroe, CHICAGO.
206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

INDEX TO ADVERTISERS.

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AS OTHERS SEE US.

AFTER two years of publication, the flow of "good words" to the editor's table continues in a steady stream for the gratification of the publishers. The writers of the following will please accept our thanks:

[SHINKLE ICE CO., Huntington, W. Va.]

ICE AND REFRIGERATION is the best paper of the kind published, and we would not be without it.

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I don't know which I appreciate most, or which is more essential to my business welfare, ICE AND REFRIGERATION or my daily meals. It is certain that either one cut off would make a nonentity of a would-be wide-awake ice man. May continued prosperity light on your sanctum door and stay there.

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ICE AND REFRIGERATION is most valuable to every one engaged in the ice or cold storage business.

[HYGEIA CRYSTAL ICE AND COLD STORAGE Co., Uniontown, Pa.]

We appreciate ICE AND REFRIGERATION more and more every day. It helps one out of many a snap.

A STORY has been going the rounds of the papers about the discovery of an ice quarry in Scott county, Va., where all they have to do is to cut out the ice in great big chunks while nature runs the ice factory. But a West Virginia man lays over this with a story of a spring in his state, the water of which is several degrees below freezing point, but never freezes. "When the people around there want ice," says this West Virginian, "they fill a bucket of water, souse it in the spring and tote home a bucket of sure-enough ice; and when they want ice cream they just mix up the cream and trimmings, chuck the stuff into the spring and have it friz." There is some sense in a spring like that, remarks the man who sits on the fence, and most anything may be expected to come out of a state which "has such daisy springs or such blooming liars."

THE Nashville (Tenn.) *Banner* has started an ice fund for the benefit of the suffering poor of that city during the hot months, and is doing a good work. A subscriber of the fund recently wrote: "There are hundreds of people in Nashville who will walk a mile to give you money for this fund if you keep the matter before them, and they understand the suffering that a sick person undergoes in a little two-room box house that the sun beats on all day. Three or four pieces of ice clinking in a glass beats string-based music at this season of the year. There isn't a man in Nashville who wouldn't turn his pockets inside out if he could see one of these poor, watch-worn mothers sit by her husband's or child's bedside and dole out the little lump of ice to the feverish lips."

[*Written for* ICE AND REFRIGERATION.]

MECHANICAL REFRIGERATION.*

THE VARIETIES OF REFRIGERATING MACHINES—ALL HAVE THE SAME EFFICIENCY WHEN PERFECT—THE COMPRESSION AND ABSORPTION MACHINES.

BY GEO. RICHMOND, M. E.

[*Concluded from July issue, page 11.*]

In practice by the operation of many causes we do not by any means obtain this maximum result. The actual state of affairs in the compression machine is represented in Fig. 5. To obtain a certain quantity of work, say 1-horse power, represented by the rectangle *W*, we are compelled to expend a much larger amount of heat than that represented in Fig. 3; let the heat actually expended be *XH*. For example, if the minimum amount possible were that represented by ten pounds of steam per horse power we might have to expend 25 pounds. In this case *X* would be 2.5.

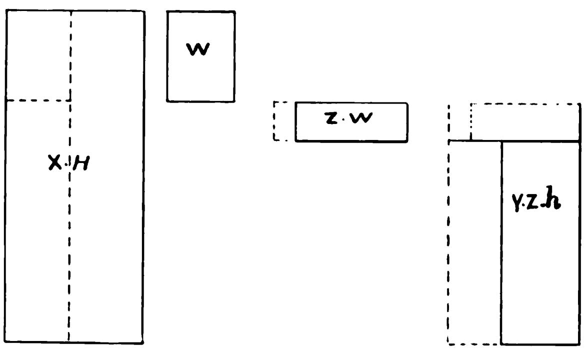


Fig. 5.

Again when we transfer this horse power of work from the engine to the compressor we lose a portion of it by friction. Let the remaining work utilized in the compressor be *ZW*. For example, if 20 per cent of the work is lost in friction, *Z* is equal to .8.

Finally for every horse power of work expended in the compressor we fail to get the total refrigeration represented by *h* in Fig. 3. Let the amount we actually get be *Yh* per horse power, but since 1-horse power in the engine only furnishes *Z* per cent of this power to the compressor it will cause a refrigeration of only *Z* per cent of *Yh*, that is *ZYh*. Equation 3 then must be modified by multiplying the numerator by *YZ*, and the denominator by *X*, and becomes—

$$\frac{h}{H} = \frac{ZY}{X} \times \frac{T}{T} \times \frac{\theta'}{\theta} \qquad (5)$$

X, *Y* and *Z* can usually be found for any particular compression machine with very little trouble. Each represents the ratio between the actual and the theoretically possible.

Official tests of refrigerating machines usually furnish us with data for obtaining the values of these quantities, and by tabulating them we have the means of ascertaining whether our own machine is doing better or worse than the average. We shall soon see that the values of these quantities vary with the different ranges and temperatures used, so that to make a just comparison we select a machine with nearly the same conditions of temperature as our own. That machine of the two which has the lesser value of *X* is run by a superior engine; that machine which has the greater value of *Y* has a superior compressor, while the machine having the greater value of *Z* runs with the lesser friction. In analyzing experimental data we are met with an embarrassing variety of terms and modes of investigation, and to make full use of the facts set forth it is necessary to have a clear idea of the modes of exhibiting them in general use.

The fractions in equations 1 and 2 are sometimes termed the efficiency of the engine, and the compressor, respectively. The term itself is objectionable, and is a relic of the time when it was not understood why we could not convert the whole of a given amount of heat into work; our object, however, is not to criticise terms, but to understand their exact significance. These fractions, which are written e_1 and e_2 respectively, we will distinguish by the name of absolute efficiency, and the absolute efficiency of the whole apparatus is the product of these two. The fraction $\frac{e_1}{X}$ is called the practical efficiency of the engine. The real efficiency is evidently the quotient of these two, or $\frac{1}{X}$ for the engine and *Y* for the compressor. This is plain enough; for if *X* is 2 we use twice as much heat as we ought, and the real efficiency is $\frac{1}{2}$. These efficiencies are arranged in the table below, which will enable us to determine the exact relation of the terms when we meet with them again in the books we may have occasion to consult.

EFFICIENCY.

Various meanings of the term in common use:

	Engine.	Compressor.	Refrigerating Machine.
1 Absolute efficiency...	$e_1 = \frac{\theta'}{T}$	$e_2 = \frac{T}{\theta}$	$e_1 e_2$
2 Practical efficiency..	$\frac{e_1}{X}$	Ye_2	$\frac{ZY}{X} e_1 e_2$
3 Real efficiency.......	$\frac{1}{X}$	Y	$\frac{ZY}{X}$
4 Special efficiency....	$\frac{1+x_1}{X}$	$\frac{Y}{1-y_1}$	$\frac{(1+x_1)}{(1-y_1)} \frac{ZY}{X}$

The fourth line gives a further example of the extended use of the word efficiency, the meaning of which may be briefly explained. The additional heat expended in the steam engine may be divided up into a number of portions, each due to some particular cause, and the complexity of experimental data arises chiefly from the investigation of these individual causes; that is:

$$X = 1 + x_1 + x_2 + x_3 + etc. \qquad (6)$$

On investigation it may turn out that the item x_1 is due to causes entirely beyond the control of the engine builder, and capable of calculation from the physical properties of the agent used. As he is anxious to make as good a showing for his engine as possible, he says, not without reason, that x_1 ought not to be included with the unnecessary heat, but among the necessary heat. He makes his fraction of efficiency, then—

$$\frac{1+x_1}{X}$$

Another experimenter may claim that the expenditure of the portion x_2 could not be avoided in any practical machine, and he includes it among the necessary heat, and makes his fraction of efficiency—

$$\frac{1+x_1+x_2}{X}$$

There can be no difficulty in interpreting these results

when we are informed beforehand of the exact nature of the supposition made. In the same way the items of which the missing refrigeration is made up may be written—

$$Y=1-y_1-y_2-y_3,\ etc. \qquad (7)$$

and may be discussed individually. Fig. 6 shows in a diagram some of the various ways in which these individual items are discussed in different text books. Fig. 6 (*a*) is the method we have expressed in equation

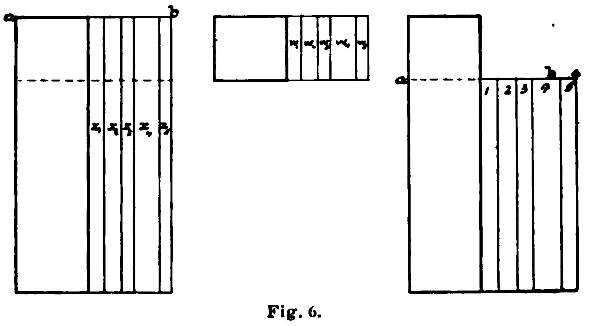


Fig. 6.

6. Fig. 6 (*b*) is what may be called the missing work method. From the total heat supplied we ought to get the whole rectangle of work, including the heavy rectangle *W*, and the items of lost work, w_1, w_2, etc. It is evident that Fig. 6 (*b*) is got by cutting off the top of Fig. 6 (*a*), and that each item of missing work corresponds, and is proportional to, each item of additional heat.

We discover the fact that more heat than necessary has been supplied by examining the amount discharged from the engine, which indeed seems the most natural place at which to measure the additional heat, for we cannot be sure that we may not get some work out of it until it has actually fallen to the lowest temperature. The rectangles x_1, x_2, etc., here appear—Fig. 6 (*c*)—as corresponding rectangles of equal area and of proportionately greater width. The additional heat is equal to the total width of the rectangles 1 to 5 multiplied by the height, *i. e.*, the temperature of discharge.

The missing work w_1, w_2, etc., is sometimes called the dissipated energy, being work which it was theoretically possible to realize but which we failed to obtain. In figure (*c*) *a c* is the width of rectangle of discharged heat, and figure (*a*) *a b* is the width of the rectangle of received heat. If we place (*a*) on (*c*) they will fail to cover each other in two parts; and since the whole figures themselves are equal, the uncovered parts must be equal. One of these uncovered parts is seen to be the total missing work, the other uncovered part is the rectangle having a width *b c* (equal to the difference of *a c* and *a b*) and a height equal to the temperature of the discharged heat. This is a convenient method of finding the total missing work when the amount of heat received and that discharged are known, which may be thus expressed when the above diagrams are used:

*The total missing work (or dissipated energy) is equal to the product of lowest temperature by the difference of the heat-widths of the received and rejected heat.**

In the absorption machine we cannot investigate the quantities *X*, *Y* and *Z* separately, we can only find the value of—

$$\frac{ZY}{X}$$

or the ratio between the actual refrigeration per unit of heat expended and that which is theoretically possible. One general principle, however, will guide us in each case. Every loss of efficiency may be regarded as an uncompensated transfer, or a transfer of heat from a higher to a lower temperature without transferring the available portion into work or its equivalent. Whenever we can place each band on two pipes of different temperatures, we may look out for examples of waste work or loss in efficiency and set about calculating its relative value. As examples may be mentioned, cold water flowing into boiler, hot ammonia flowing into refrigerator, superheated gas flowing into condenser.

* The quantity which appears on the diagrams as heat-width is also termed "heat-weight" and "entropy."

AS to the economy of the pipe line system of refrigeration, Mr. John E. Starr, in his article on that subject in a recent number of the *Engineering Magazine*, says: "The results in St. Louis and Denver have shown that the business may be successfully carried on with an annual return no greater than $7,000 for each mile of mains. In the business districts of the larger cities the demand for refrigeration per mile would be much greater than this. A canvass of five miles of streets in the business portion of St. Louis, for example, showed a present consumption of ice amounting to $170,000 per annum, basing the cost of ice (delivered) at the low price of $4 per ton. A canvass of three miles in Kansas City shows a demand of $72,000. In the better residence portions of these cities the consumption of ice is estimated at $5 per ton, at from $12,000 to $16,000 per mile. In the middle class section the annual demand, at the same price for ice, is from $8,000 to $12,000 per mile. It is safe to say that any American city of 20,000 inhabitants could readily support the pipe line system."

MR J. J. Coleman, of Glasgow, is quoted in a cotemporary as having made experiments with various materials for refrigerator insulators, finding their heat conducting power as follows: "Mineral wool, 100; hair felt, 117; cotton wool, 122; sheep wool, 136; infusorial earth, 136; charcoal, 140; sawdust, 163; gasworks breeze, 230; wood and air space, 280. According to this, mineral wool is the best for that purpose, and many refrigerator companies have adopted it. It is a vitreous substance made of scoria and certain rocks, and converted, while in a melted condition, into a fiber closely resembling wool or cotton. It is composed of countless fibers, which interlace and cross each other in every direction and so form thousands of air spaces, which makes it unequaled for the purpose of filling."

AS an indication of the value of the refrigerating machinery in active use in the different cities of the Union, the following is given from a table prepared for an insurance company in 1890: "New York city, $1,751,000; Brooklyn, $785,000; Newark, N. J., $360,000; Philadelphia, $624,000; Boston, $215,000; St. Louis, $658,000; Milwaukee, $456,000; Buffalo, $152,000; Rochester, $179,000; Staten Island, N. Y., $234,000; Cincinnati, $398,000; Kansas City, $440,000; Chicago, $785,000; Cleveland, $130,000. It may be safely estimated that there is within the United States at the present time at least $25,000,000 invested in refrigerating and ice making machinery."

OBITUARY.

DEATH OF GEORGE D. CHARTER, OF THE SPRING BROOK ICE CO.—ROBERT WHITEHILL, OF NEWBURGH, N. Y.—OTHER OBITUARY NOTICES.

GEORGE D. CHARTER, superintendent of the Spring Brook Ice Co., Hartford, Conn., died at the home of his brother, Gen. Wm. Charter, in that city, on July 6, of heart disease, at the age of sixty-three years. Mr. Charter was born in Springfield, Mass., and his early life was spent at Northampton. He learned the trade of carpenter, and went to Hartford thirty years ago. He was a member of the Hartford police force about eight years, and resigned in 1875 to become superintendent of the Spring Brook Ice Co., which position he held till his death. He was the youngest of a famly of thirteen children, only four of whom now live; and he is survived by a wife and three children.

Mr. Charter was of a very retiring disposition, but having been possessed of a warm-hearted, generous nature, he was greatly esteemed by all with whom he became associated in business and private life.

ROBERT WHITEHILL, of the Whitehill Engine and Pictet Ice Machine Co., Newburgh, N. Y., died July 17, at his residence on Grand avenue, after a long and painful illness.

Mr. Whitehill was born in Glasgow, Scotland, June 1, 1845, and came to this country with his parents in 1847, and resided at Wappingers Falls until 1857, when the family removed to Newburgh. He graduated from the academy and after a period as bookkeeper and cashier in New York city he entered the foundry of Stanton, Mallory & Co., to learn the trade of a machinist. He remained there until the suspension of the firm, and during that period, with his father's assistance, he invented a machine for sizing and dressing cotton yarn, which he put into operation at the Newburgh steam mills, of which his father was superintendent. Subsequently he engaged as a journeyman with the Novelty iron works, of New York, where he acquired valuable experience in constructing and erecting the machinery of steamships. A year later he entered the United States navy as third assistant engineer. In 1865 he returned to Newburgh and rented a portion of the steam engine works of Corwin, Stanton & Co., and for five years thereafter was engaged, with his father as a partner, in the manufacture of his patented machinery. The changes which then occurred in the Corwin foundry gave him an opportunity for an association with Lewis M. Smith and the laying of the foundations of an important industry, the Pictet Ice Machine Co., with which he had since been identified, and which brought him prominently forward as an engineer and machine builder. He was also interested in the Chadborn & Coldwell manufactory of lawn mowers, and altogether has been an important factor in the development and prosperity of the city.

For several years he was president of the board of trade of Newburgh. In the years 1871 and 1872 he represented the second ward in the common council, and was president of the board in the latter year. His wife, with several children, survives him.

George G. Porter, president of the Isbell-Porter Manufacturing Co., New York, died suddenly of apoplexy on Sunday afternoon, July 23, at the Crawford House, Mount Washington, N. H.

He was born in Skaneateles, N. Y., in 1835. When twenty years old he worked in a drug store in New York, and in a few years became proprietor of a drug store in Sixth avenue, between Tenth and Eleventh streets. Later he secured an interest in the Smith & Sayre Manufacturing Co., makers of gas apparatus and machinery. Three years ago the firm name was changed to the Isbell-Porter Co., and Mr. Porter was made president. He also became treasurer of the B. P. Clapp Ammonia Co.

Mr. Porter was a member of Grace Church, New York. In 1871 he married Miss Mary Gifford, of New Bedford, who survives him. The body was taken from Mount Washington to Skaneateles, where the funeral took place on Wednesday following his death.

OTHER NOTICES.

——P. B. Goodwin, of Unionville, Conn., died at Fall River, June 22, after a long illness, at the age of seventy-three years. He was formerly in the ice and coal business at Unionville.

FIRE AND ACCIDENT RECORD.

——The Santa Fe ice house at Purcell, Kan., was burned July 11.

——A large ice house at Long lake, Venice, Ill., was totally destroyed by fire, July 17.

——The *Paragon*, a Cincinnati Ice Co.'s boat, was sunk at Lockland, Ohio, July 13; loss, $800.

——The ice houses of Postmaster Holt, of Lawrence, Mass., were burned July 4; cause, supposed incendiary.

——A temporary structure covering a quantity of ice owned by Mr. Upp, Sandusky, Ohio, was burned July 5.

——In a big fire at Luckey, Ohio, Sampson & Meyers' and Chas. Gropsy's ice houses were burned; loss, $300 each.

——Maynard Whittier's ice house at Ipswich, Mass., was burned July 6, and 500 tons of ice destroyed; loss, $700 to $800; no insurance; cause, unknown.

——One of the several ice houses of the City Ice Co., Indianapolis, Ind., formerly belonging to Patrick Ward, was burned June 27; loss, $4,000; small insurance.

——The meat storage house of Dale & Co., Scranton, Pa., was burned June 26; cause, unknown. The loss included fifty beeves, and several tons of sausage and canned goods.

——On July 3, the Beaver pond ice house of the Meriden (Conn.) Ice Co. was burned, and only a small part of the 7,500 tons of ice in store saved; loss, $5,000; insurance of $3,000; cause, unknown. The company still has 14,000 tons of ice on hand.

——The ice houses of Geo. Beck & Son., South Bend, Ind., were burned July 7. A year ago the houses of the same firm were similarly destroyed by fire. The cause of the fire is unknown, and the loss is total.

——The six ice houses of the New Haven Ice Co., Whitneyville, Conn., were struck by lightning July 13, and burned. The houses contained 15,000 tons of ice, much of which was saved. Loss to ice company, $60,000.

——An ice house of G. Cook & Son, on the shore of Lake Winnisquam, Laconia, Mass., was blown down and demolished, as was one belonging to Dunn & Sanborn, on the shore of Lake Opechee, between Laconia and Lakeport by a cyclone July 22.

——Jamieson & Bond's ice factory at Rockaway Beach, Long Island, was totally destroyed by fire June 23. The ice factory and some adjoining property formed a continuous row of wooden buildings, which took up about a quarter of a block. The structure next to the railroad track was the ice factory. In the others were located the stables, ice house, feed and grain warehouse, storage building and boiler house. The fire started about the center of the row, and is supposed to have been caused by a spark from a passing locomotive. A northwest gale which was blowing fanned the flame, and turned the row of buildings into a roaring furnace. In the crowd of spectators were two young women of Brooklyn wearing dresses of blue serge. Falling sparks set fire to one young lady's dress. She screamed, and her sister seeing the blaze, sprang to put it out, and her own skirt took fire. They cried out in mortal terror as the flames began to creep up their clothing. Their peril was over in a minute. Several men darted through the crowd and seized them. One of the men had been in bathing and had run out of the surf to the fire in his bathing suit. They threw the women in the grass, dragged off their clothing, and put the fire out. The buildings were burned to the ground. The loss is about $20,000.

THE ICE TRADE

INDISCRIMINATE WAGON SALES.

IT is a cause of complaint in Minneapolis that dealers will not allow their drivers to sell ice to people who are not regular customers ordering through the office. The complaint is that transient customers, who may need ice for emergencies, find this rule a hard one. No doubt it is; but at the same time it seems impracticable to permit wagon men to sell ice indiscriminately from the wagon.

It is not true that ice wagon drivers are more dishonest than the run of mankind, but their temptations are greater than the average man has to meet when allowed to handle ice without any system of check upon his sales. The case is illustrated by an incident at York, Pa., when the dealer told a friend he ought soon to begin taking ice of him, to which the friend replied, "Why, I've been taking your ice for some time." Examination disclosed the fact that for some time the drivers in the employ of the company had come in reporting quantities of ice wasted as high as 900 pounds for one day. Putting this and that together, the manager concluded that the company was being defrauded by its men. He began an investigation and learned that some of the drivers had been leaving ice with people whose names were not on the company's books as patrons. The money they collected was never turned in.

The problem how to serve the people, and at the same time remunerate the company or individual ice dealer, is therefore one not easily solved, and the line must be drawn somewhere. The ticket system might answer, the dealers issuing a small coupon book (unused coupons to be redeemable), or tickets which could be bought of drug stores, etc., in any quantity good for a given weight of ice from the company's wagons or any wagon, the dealers redeeming each other's tickets. Transient buyers could then keep a small number of tickets on hand for emergencies, using them as needed, the tickets to be returned as cash by drivers, who should be forbidden to sell tickets at any time, since the public could buy them at drug or grocery stores *ad lib.*

THE TRADE.

THE month of July has been most favorable to the trade in all parts of the country, the weather having been very warm all through the month. The factories in the South all report a good business, while the trade north seems to have all the business it can handle. Prices remain firm, and there is less complaint by the trade of cutting than has been heard for several years. It really looks as though the season would be a profitable one.

THE difficulties between the dealers at Washington and the representatives of the government departments were adjusted on June 29 last, by the agreement to a uniform price. The companies satisfied the representatives of the departments that the rates now being paid did not cover the actual cost, these low rates being due to the fierce competition between the local companies which existed some time since. The rates agreed upon for the next four years, the companies showed, were below what has always been paid by the government, and no more than private dealers were paying. The price agreed on was 28 cents per hundredweight.

The agreement reached is in every way satisfactory to all concerned, and assures the government of certain service of the very best quality of northern and manufactured ice, and this by the established local companies. The bid submitted to them by an organization about to be formed was practically withdrawn, the representatives of the new concern having admitted their inability to supply the ice as desired.

The Great Falls Ice Co. will supply the District government offices at 35c. per cwt.

All bids for furnishing ice to the government hospital for the insane were rejected July 5. The bids offered were: Hygienic Ice Co., 40c. per hundred pounds: American Ice Co., 41c.; Transparent Ice Co., 41¼c.; Great Falls Ice Co., 40½c.; Independent Ice Co., 42c.; and National Capitol Ice Co., 42¼c.

ICE, which has been selling at 15@25c. at Charleston, S. C., has gone up since July 1. The query is suggested: Is this one of the results of the new liquor law that went into force July 1, giving the state full control of the saloon business? However that may be, it is certain the closing of the saloons in Charleston has largely reduced the demand for ice by killing a trade which was a large consumer of ice; and on July 1 the dealers made the announcement that on and after that date prices would be as follows: One ton, $6; 1,000 lbs., $3.50; 500 lbs., $2; 100 lbs., 40c.; 50 lbs., 25c; 25 lbs., 15c.; 15 lbs., 10c.; 7 lbs., 5c. At ice houses, 1,000 lbs., $3; packed in barrels, 60c. per cwt.; in sacks, 50c. per cwt. The increase is considerable, but the price is still low, and the consumer there has no real cause for a "kick."

THE dealers at Detroit have come to an agreement which Mr. Schweikert, of the Schweikert Little Four Ice Co., outlines as follows: "According to our agreement, we meet every week and reports are received. If any dealer has been selling under the scale he is roasted, and if there is a customer of any of the members who

has not paid his bills the fact is reported so that he can get no ice from any other dealer until he has settled. Here is our scale of prices: Four pieces per week, $1.50 per month; seven pieces per week, $2 per month; fourteen pieces per week, $3.50 per month; six pieces per week, $1.75 per month. These prices are the same as those of last year, except for seven pieces per week, which is twenty-five cents more than most of the dealers asked, but it is the same rate that I obtained last year. Every dealer in the city has entered into our arrangement, and our organization is almost perfect. We tried to do the same in the past, but never succeeded, as some dealer always went in to undersell the rest on the sly and work up a big trade for himself." Mr. Hacker, of Hacker & Dean, is quoted as saying: "The principal effect of the combination is to put an end to the long credit system. Ice must be paid for weekly. We have learned a lesson. There has been some talk of forming a trust combination composed of all the ice men of the city. This would be in order to district the city and give each firm an exclusive territory. It would do away with the necessity for the employment of so many teams. I don't think a trust will be formed in the immediate future, however."

ICE TRADE ITEMS.

——Cold cash—the ice man's fortune.—*Ex.*

——The great "ice combine" has not yet materialized in Cincinnati, but the discussion has had the effect of uniting the trade on an agreement as to prices, which is not without a material value to the trade as a whole.

——The good people of Minneapolis are up in arms because the ice dealers have decided to no longer permit indiscriminate sales of ice from their wagons. The trade understand the bottom causes for this ruling, which is aptly put by a local manager: "We want all our men to meet us in heaven, and should we allow them to steal our money, of course they could not."

——Ice consumers at Batavia, N. Y., who think the price of twenty-five cents per hundred too high, talk of organizing a $5,000 company to "co-operate." Ice, we are told by these "sufferers" "will be sold at the lowest possible figures, and only stockholders will have the privilege of buying ice." When the company shall have sold ice a few seasons for less than twenty-five cents the stockholders will hardly consider the privilege a valuable one.

——The ice trade at Evansville, Ind., have come to an agreement as to prices. The rate for small lots is quoted at 50c. per cwt. A local newspaper says it "has been informed that the ——— Ice Co. could sell ice for 7c. per cwt. and realize a fair margin of profit" One imagines that this editor will, in all seriousness, tell his people next that it has been informed that cottage cheese can be found growing on blackberry bushes in the wilds of Vanderburgh county.

NATURAL ICE NOTES.

——Henry Glos is building a 20×40-foot ice house at Melrose Park, Chicago.

——Ice is going out of the houses at Pekin, Ill., at the rate of a train load daily.

——Florsheim & Teasdale are building an ice house and stable at Wheeling, W. Va.

——E. & I. K. Stetson began shipping ice from their lower houses at Brewer, Me., July 17.

——The Huse & Loomis Ice Co. shipped a large load of ice from Peoria to St. Louis, June 20.

——Rogers, Thomas & Frederick, Hamilton, Ohio, are shipping Sheley pond ice to Cincinnati.

——The Pennsylvania company will rebuild the ice houses recently burned at Wilkinsburg, Pa.

——M. G. Colehamer, of Brunswick Centre, N. J., has gone to Newark to go into the ice business.

——Ice shipments from Brewer, Me., have begun in earnest, and the ice houses are looking alive again.

——John Lang, West Troy, N. Y., has sold 10,000 tons of ice to go to Montgomery Bros., New York city.

——The Knickerbocker Ice Co., New York, is building a new dock at Lockland lake for loading ice on steamers.

——P. Bradley's ice house at Leavenworth, Kan., was broken into by thieves, July 11, who carried off some 1,400 pounds of ice. Ice stealing is a new scheme, certainly.

NEW ICE FACTORIES.

THERE is considerable new work going on for this time of year, which confirms our idea expressed during the past winter that the immense harvest would not, as so many "experts" said, "wind up the ice machine business for good." Our record of work for the month is as follows:

ALABAMA.

Mobile.—The Consumers' Ice Co. have let the contract for an additional 20-ton ice machine. The work on the foundations has begun, and the machine will be set up this fall.

FLORIDA.

St. Augustine.—G. G. Springer, the junior member of the firm of A. Springer & Son, of St. Augustine and Fernandina, has contracted with Columbus Iron Works Co. for a 10-ton ice machine, to be erected at Eau Gallie, and a 20-ton machine for Palm Beach. Work will be begun at once. He has also closed a ten years' contract with Mr. H. M. Flagler to furnish all ice needed by his hotels, railroads and steamboats in Florida.

Key West.—John R. Scott has ordered a 10-ton ice machine, built by the Sulzer-Vogt Co., of Louisville, Ky., to be ready by August 15. The plant will have cold storage facilities also.

GEORGIA.

Glasgow.—Henry Raubold is interested in a new ice factory projected here.

INDIANA.

Jeffersonville.—The Jeffersonville Artificial Ice Co., now making twelve tons of ice daily, are making arrangements to enlarge the plant to twenty-four tons daily.

MASSACHUSETTS.

Dorchester.—About a year ago the project of an ice factory was discussed, and then apparently dropped. Work has since been going on in the organization of a company; land was purchased, and a subscription list opened. Stock to the amount of $60,000 was placed, and the prime movers met recently and organized as follows: President, J. Frank Howland; treasurer, Wm. Carroll Pope. The directors are the above named, and John P. Spaulding, Thomas F. Temple, George A. Fisher, Frank Wood and Stephen H. Whidden. Contracts will at once be placed for the buildings and machinery and for the artesian well, which will furnish water to make steam, which, when distilled and condensed, is frozen. The new company organized under the laws of Massachusetts, with a paid-in capital of $60,000, and has received its charter. It will be known as the Dorchester Hygeia Ice Co.

MISSOURI.

Jefferson City.—Moerschel Bros. have just completed an ice making plant in connection with the brewery, and are making fifteen tons of ice daily for the city retail trade.

NEW YORK.

Buffalo.—Ice will soon be manufactured on Fulton street, the new plant of the company on that street being almost completed. It is four stories in height, and constructed of brick.

PENNSYLVANIA.

Allentown.—F. X. Kuhn has just finished setting up an ice machine for Butz & Rieff.

Chester.—John L. Price's new ice factory on Folsom road is ready to make ice.

Greensburg.—The Hygeia Ice Co., while drilling a well for cooling water, struck gas at 213 feet—a strong flow which is increasing in pressure. Should it hold out, the company will use it in lighting the plant.

Nazareth.—It is reported that capitalists of Slatington will build an ice factory here.

Ogontz.—The ice making plant of W. H. Shoemaker has been finished at a cost of $15,000. The output is forty tons, which goes to Washington, D. C.

Sheridan—Messrs. S. S. Long & Bro., of New York, who own considerable interests in Millcreek township, have given the contract to Mr. Reuben Price, of Reading, for the construction of a cold storage house, near Sheridan, where they have already two houses. The Messrs. Long are extensively engaged in the egg business.

West Chester.—The West Chester Cold Storage and Ice Co. have entirely recovered from the effects of their recent fire, and are making more ice than ever. The loss of the ice house, which was destroyed by fire, is felt more at the present than at any time since the fire. In it was stored a large quantity of ice which was intended as a sort of reserve upon which to draw in time of need, and it would have been increased to many hundreds of tons but for the accident. The company must now depend upon the capacity of the plant for its entire supply.

TEXAS.

Madisonville.—A new ice factory, erected by R. P. Turner, will be ready to begin operations soon after August 1.

Yoakum.—James Blanks has put new machinery in his ice factory, increasing its capacity to ten tons daily.

ANSWERS TO CORRESPONDENTS.

SPEED OF RUNNING COMPRESSOR—STRENGTH OF AMMONIA IN ABSORPTION MACHINE—MATERIAL FOR PACKING ICE.

[This department of ICE AND REFRIGERATION is conducted for the benefit of the trade generally, as well as individuals; and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

To the Editor: Will you kindly answer on the enclosed addressed P. C. the following? What is the best speed at which the engine which drives the compressor should be run? Our machine is a Shuehle, and the engine can be speeded up to 250 revolutions. It seems that time is necessary to obtain the full effect of the expansion of the ammonia as it is drawn through the coils of the brine tank, and a loss of refrigerating power occurs if the suction and compression pumps are worked as rapidly as possible. It requires ten hours to freeze one ton of ice, the capacity of our plant; the temperature of our water is 82°, so that this is what the ammonia coils have.

We are obliged to rely upon unskilled labor to run our machine, and without ICE AND REFRIGERATION we should be wholly "at sea." T. E. W.

ANSWER.—We think you would get the best results by running under 200 revolutions. It is possible that owing to the thickness of the iron of your pump, the removal of the heat generated by friction and the compression of the gas may be too slow when running at a high speed, in which case the result would be a reduced suction power of the pump on account of the high temperature of the interior lining thereof. You can test this theory by the experiment of running at lower speeds, and noting the effect.

STRENGTH OF AMMONIA IN ABSORPTION MACHINE.

To the Editor: We recently have had an absorption machine erected. I would like to ask you what is the strength of the ammonia in ordinary practice in absorption machines. We use from 20° to 26° Beaume's scale. What would be the objection to using 40° or 50° or even pure anhydrous? These questions, I suppose, have been answered in ICE AND REFRIGERATION, and if you have these papers on hand, please send copies of same. A. B.

ANSWER.—We do not recollect that the above questions have been answered in particular in any former issue, although a study of the various articles published by us on the subject of absorption machines would doubtless lead you to an answer to your questions. In itself the matter may be elucidated in the following manner: The refrigeration in both an absorption as well as in a compression machine is produced by the evaporation or vaporization of liquid anhydrous ammonia. The ammonia so volatilized, in order to use it over again in the same manner, must be liquefied. This is done by mechanical compression in the case of the compression ice machines, and by absorption in water in the case of absorption ice machines. From this it readily follows that anhydrous ammonia cannot be used in an absorption machine, as there would be no water to re-absorb the ammonia once volatilized, this being the principle on which the absorption machine works. The amount of water required depends on circumstances, as the affinity of water for ammonia varies with the temperature, it being less at higher and greater at lower temperature. Generally speaking, there should be sufficient water to take care of all the volatilized ammonia at the temperature of the absorber.

On the other hand, there should be no more water than is absolutely necessary, for the stronger the ammonia the less heat will be needed for the disassociation of the ammonia in the generator, or still. The gas will also be more anhydrous, the stronger the ammonia solution can be used, and less power is used to work the aqua pump, etc. It is evident from this also that a liberal supply of cooling water will allow a stronger solution of ammonia without increasing the back pressure, and an increase in the latter will have the same effect in allowing a stronger solution of ammonia to be used. We presume that in an ideal machine the absorber could be constructed so as to allow only ammonia of the greatest possible strength (obtainable under the working conditions of the machine) to enter the still; that is, within certain limits. In using your ammonia at from 20° to 26° Beaumé, we think you hit pretty nearly the average adapted to most working conditions. In fact, we think that 23° is about as high as it is necessary to go in most cases, while 26° is probably a higher concentration than is really necessary in most machines.

MATERIAL FOR PACKING ICE.

To the Editor: Up to date we have been shipping ice by express in oat bags well packed in sawdust. Recently this sawdust has become quite an expensive article. Now, do you know of any other way to ship ice in 100-pound lots to preserve it? If you do not, please look into the matter and inform us as soon as possible. Possibly some kind of paper or paper bag may be utilized. ED. W.

ANSWER.—A friend in the South, at our request, makes the following suggestion: "In our business we use fine shavings, sawdust or rice chaff, the latter no longer obtainable at a figure that would pay to use it in this section. Louisiana raises rice, and probably your correspondent could get chaff, which is cheaper in the end than sawdust, for it can be dried out and re-used. Shavings from planing mills answer when you cannot get dust or chaff. In speaking of re-using chaff have reference to shippers using their own ice cars which are returned with the material used for packing in them."

A WRITER in the *Scientific American*, some time since, in speaking of the pipe line refrigerating system as in use in Denver, said: "The system operated by this company is covered by a combination of twenty to thirty patents, the most important of which applies to the storage of the surplus refrigerant in receivers to be drawn upon as wanted, obviating the necessity of the continuous operation of the machine used in the manufacture of the anhydrous ammonia. The machinery is a modified type of the absorption machine. The construction of machinery suitable for pipe line work necessitated a number of costly experiments, as the variations in the rate of the refrigerating load are often 65 to 70 per cent above or below a daily rate, and such changes often occur within a very short space of time. Such perfection has been attained in this particular that the machine equalizes the pressure automatically without attention from the engineer, and adjusts itself to the irregular use of the liquid. The company claim that its safety devices and its system of operation are such that any serious accident is an impossibility."

THE publishers of ICE AND REFRIGERATION are prepared to fill orders for bound copies of Volume IV of this paper, uniform with Volumes I, II and III, at $5 per copy bound in half morocco, and $4 per copy bound in half leather. Those of our readers who wish to have their own copies bound may send them to this office, where they will be bound as above at $4 and $3 per volume respectively, the sender paying express charges both ways.

[*Written for* ICE AND REFRIGERATION.]

LEGAL NOTES.

AN INTERESTING LEGAL DECISION FROM IOWA ON THE RELATIVE RIGHTS TO ICE OF PURCHASERS FROM LANDLORD AND TENANT—MINOR LEGAL NOTES.

THE Supreme court of Iowa has rendered a very instructive decision, in the case of *Marsh* v. *McNider*, which was a suit in equity to restrain McNider & Co. from cutting or otherwise interfering with ice, and to recover the value of ice which they had cut, which was claimed by Marsh.

The facts of the case were that one Clara E. Doud was the owner of a certain tract of land west of the center of a stream of water which flowed across it, which stream was about eight rods in width and not navigable. Mrs. Doud made to Marsh a bill of sale of the ice which should be formed in her part of the stream during the winter which commenced in the year 1890. When Mrs. Doud purchased the land, in June of that year, it was occupied by S. M. Fulghurn, as sub-tenant, under a lease which gave him the right to the free and uninterrupted occupation thereof until April, 1891, and the title acquired by the purchase was subject to his rights under the lease. He sold to McNider & Co. the ice which was included in the bill of sale to Marsh, and, after the ice was formed, they cut and removed portions of it for their own uses. Marsh contended that the ice was real estate—a part of the land owned by Mrs. Doud; therefore, that the lease gave to the tenant no right to remove it; and that the bill of sale transferred the ownership of it to him.

It is well settled, said the court, that, under some conditions, water and ice are to be regarded as real estate, belonging to the owner of the land which is beneath it; and, when that is the case, the land owner or his assign has the exclusive right to gather and dispose of the ice for his own benefit, subject to the rights of other riparian owners. The owner of land has the right to use so much of the water of a stream flowing over it as is necessary to supply what are termed his "natural wants." Where he does not own the soil under the stream, as where it is meandered, and his ownership does not include its bed, he has no exclusive right to the ice which forms in it. In such cases, whoever has lawful access to the stream may use the water and the ice which forms therein in such manner as does not interfere with the rights of the riparian owners. Whether the ice which forms in a running stream is to be regarded technically as a part of the land over which it is formed or to which it is attached is a question the court did not find it necessary to determine. It is water congealed, it said, and, although more readily secured and controlled for many purposes than water, it is in most respects subject to the rules which govern the rights of the riparian proprietor to the water. Ice may be attached to his land, but it was not produced by the land, drew nothing from it, and will give nothing to it. It is transient by nature, and will soon disappear, unless prevented by the labor of man. It is a product of the changing seasons, which the occupier of the soil may use as he might have used the water from which it was formed. If he own the land under it, he may use the ice as he might have used the water, to suppy his natural wants, and for other purposes, so far as he can do so without affecting the rights of others, as of lower owners on the same stream. Such use appertains to the land, and belongs to him who has the right to possess and use it. In this case that right was conferred upon Fulghurn, by virtue of the lease. It is said that his lease was for ordinary farming purposes only, but, if that were true, he would have had the right to use so much of the water and ice as he required for such purposes. The lease, however, does not restrict the tenant to the use of the premises for agricultural purposes only, but gives him the right to the "free and uninterrupted occupation thereof," and necessarily the right to use them and their appurtenances. Nothing was reserved, excepting timber not required for repairing fences. The leased premises included one-half of the bed of the stream, and such rights as the owner had in the stream itself. He retained no right to enter upon the premises to gather ice, and his grantee, Mrs. Doud, acquired none as against the tenant.

Wherefore it was held that the lease gave to the tenant the right to cut and remove the ice in question, and that such right was assigned to the purchasers from him, McNider & Co.

MINOR LEGAL NOTES.

——Eugenie Stevenson has been appointed receiver for the Saddle River Ice Co., Paterson, N. J.

——The receiver for the Stone Lake Ice Co., Hamilton, Ohio, June 23, sold the Lorenz ice house to Robert Reynolds, of Cincinnati, for $5,600.

——The works of the Montclair and Bloomfield Crystal Ice Co., Bloomfield, N. J., have been seized for debt, and will be sold by the United States marshal on August 10.

——Frederick Doebel has entered suit in the United States circuit court against the Consumers' Ice Company of New Orleans, for $10,000 damages. The plaintiff's son was killed in a boiler explosion at the factory of the above company.

——Robert Whitehill, uncle of the late Robert Whitehill, president of the Whitehill Engine and Pictet Ice Machine Co., has been appointed receiver of that company in consequence of a desire on the part of the owners to dissolve the corporation. Further proceedings are to be had November 13, in the courts. An injunction has been granted restraining suits against the company in the meantime.

——A. H. Wick and N. A. Gilbert have been appointed receivers for the Cottage Grove Lake Ice Co., of Cleveland, at the suit of the Wick Banking and Trust Co. as trustee for the holders of $25,000 worth of bonds against the company. A half year's interest on the bonds fell due in June, and as it was not paid the bank was obliged under the terms of its trust deed to apply for a receiver. There will be no stoppage in the company's business. Ice will be delivered regularly as heretofore and all contracts will be filled.

——The suit of the *Grand Rapids Ice and Coal Co.* vs. *The South Grand Rapids Ice and Coal Co.*, at Grand Rapids, Mich., involves a law point interesting to ice harvesters. The complainant leased frontage at the lake for the ice privilege and claimed the riparian rights included in the lease extended to the middle of the lake. The defendant company last winter infringed upon the complainant's leasehold in cutting ice, and the suit is to recover $1,200, the value of the ice cut by the defendant. The suit involves the riparian rights in the lake and it will undoubtedly go to the Supreme court for final review.

——On July 10 Geo. M. Moulton was appointed receiver for the Chicago Cold Storage Exchange, located at the west end of Lake street bridge, Chicago. It was alleged the Exchange could not meet its obligations, and as there were perishable goods to the value of $75,000 stored in the warehouse the suspension of business by seizure by attachment would entail great loss. The receiver is empowered to carry on the business until owners have removed their produce, when it is to be wound up. Ninety days from July 14 were allowed for filing of claims. The corporation has a ninety-nine-year lease on the property where it is at present doing business, which does not run out until 1988, for which an annual rental of $45,160 is paid. The leasehold, with the buildings thereon, valued at $700,000 and incidentals, valued at $5,000, it is represented, constitute the real assets of the defendant corporation. It is stated further that the lease and buildings are subject to a trust deed to secure bonds for $200,000, and that outside of this the indebtedness of the corporation exceeds $200,000.

IN SPEAKING of the recent reductions in the force of meat inspectors by Secretary Morton, of the department of agriculture, a chief of one of the departments at Kansas City is quoted as saying: "The service will not be impaired in the least by the reductions. The packing houses are doing a great business in beef, but less than usual in pork on account of the irregularity in the market; and as the greater part of our work consists in inspecting pork it can readily be seen that a very large force was useless." Nevertheless the reductions at Kansas City represent $26,600 in salaries.

THE new packing house of the Nashville (Tenn.) Packing Co. is about completed and will be started up September 1, with capacity for 1,000 hogs, 150 cattle and 300 sheep daily. The company is capitalized at $500,000, a large part of which is held by John Cudahy. J. J. Delaney is resident manager, and John Blouchard, chief engineer; the number of men employed will reach 200.

The plant is a stone and brick building 248×190 feet in size, four stories high, with front on Line street, and railway tracks to the building and stock yards. A retail store will be operated, and a large wholesale room for local butchers' trade.

The engine room is in the western end of the building. In this there are two engines of 175-horse power each, and two Linde refrigerating machines made by the Fred. W. Wolfe Co., Chicago, with a capacity of 150 tons, and also a 175-horse power engine. There are also two brine tanks of 37,000 gallons capacity each. The brine is forced through the coils in the cold storage rooms by a force pump. On this same floor are the boiler rooms containing a battery of four boilers of an aggregated capacity of 500-horse power. In an adjoining room there are six large tanks for rendering lard and a tankage press and dryer for making the offal into fertilizers. The killing room is on the fourth floor, whence the dressed carcasses are run into the chill room, which is held at a temperature of 32°. It will hold 5,500 hogs. There are 48,000 feet of coil pipe in this room. The hog remains here seventy-two hours. Thence it goes to the chopping block. From here are chutes leading to the lower floor, where are located the salting and curing rooms. On the next floor there is another cold storage room and five smoke houses with a capacity of 150 tierces of meat each, as well as two smoke houses for sausages, a sausage room where pork, bologna and Frankfort sausages will be manufactured.

There are also lard rooms and a cold storage room for cured meats. This last room will be kept at a temperature of 42°. This room contains 24,000 square feet. On the next floor under this there is another cold storage room of 19,000 square feet and a shipping room 85×40 feet.

THE new Cudahy packing houses at Cudahy, near Milwaukee, are rapidly approaching completion. Early in July, W. R. Perrin & Co., Chicago, were at work placing the hog rails and travelers. There will be 26,000 feet of rails for the hogs and 4,400 beef rail, 15,000 travelers, 18,000 Gambrel sticks, two friction hog dumps, three hog hoists, beef hoists, droppers, etc. The Vilter Mfg. Co., Milwaukee, was also at work in erecting the ice machine and piping, this company having the contract to furnish the ice machines and piping for 176,480 cubic feet of space in the refrigerator building and 2,703,360 feet of collar piping. The brine pump has already been placed.

THE total number of cattle killed at Kansas City for the six months ended June 30 reached 370,677, against 248,890 the same time last year, an increase of 121,787; sheep, 147,167, against 65,897 the same time last year, an increase of 81,270; and of hogs there were 766,586 slaughtered.

PACKING HOUSE NOTES.

——Kingan & Co. have recently made several additions to their plant at Kansas City.

——Swift & Co. reopened their works at South Omaha, July 13, after a short shut-down.

——The Silberhorn Packing Co., Sioux City, has wound up its business, and on July 1 the buildings were locked up.

——The Sioux City Packing Co. contemplates erecting a new slaughter house for cattle, the old house being too small.

——The G. H. Hammond Packing Co., South Omaha, on July 13 began setting up machinery to double the capacity of the cooling plant. The investment represents $50,000.

——The Fowler Packing Co., Kansas City, July 8, executed a deed of trust for $700,000 to cover 6 per cent twenty-year bonds. The proceeds will be used to pay indebtedness and to materially enlarge the plant.

——It is reported in Denver that Armour & Co. will next spring build a packing house in that city. Ten additional agents of the company, with headquarters at Denver, have been put on the road by the local branch.

——It is anticipated in St. Louis that the F. Whittaker & Son Packing Co., recently placed in the hands of a receiver, will be reorganized. English capital is said to be interested, and that a new syndicate will be organized with capital of $2,000,000 to $3,000,000, of which the Whittaker interest will be $500,000.

——All the packing houses in Kansas City are largely increasing their slaughter of beef, Swift & Co. are shipping dressed beef to their Chicago canning house, and the new firm, Schwartzchild, Sulzberger Co., are killing for export. It is expected that the number of beeves handled in the city will this season be larger than ever before.

——The first fire in sixty years in the history of the Morrell packing firm, Ottumwa, Iowa, occurred July 12 when property worth half a million was licked up by the flames. The warehouses took fire from the electric wires in the building, near the elevator, and in an instant the whole structure was in flames. These houses contained the cellars, cutting and weighing department, chill rooms, lard refineries, smoked meat department, jobbing rooms and offices. The packing house had been slaughtering 1,500 hogs daily, and at least $200,000 worth of product was consumed. The main buildings, containing the most valuable machinery and the engines, and the warehouse containing the pickled meats, were saved. The plant was covered with insurance of nearly $750,000. Mr. T. D. Foster,, the general manager, said that the burnt structure would be rebuilt at once.

RAILWAY REFRIGERATION NOTES.

——The Santa Fe Fruit and Refrigerator Car Co. has its own agents in Texas buying and shipping melons to the Kansas City markets.

——The Earl Fruit Co. is using from California a newly patented car, which is a combination refrigerated and ventilated car, carrying 1,200 crates. It is iced from the ends and not from the top.

——The California Ventilated Car Carrier Co. has been incorporated at San Francisco, by H. L. Kellogg, Thad. S. Fitch, Wm. Gibbons, Henry L. Boyne and T. G. Hughes; capital, $1,000,000, of which $600,000 has been subscribed.

——The Lackawanna Refrigerator Co., of Kansas City, Kan., and St. Joseph, Mo., has been incorporated, with capital of $1,000,000, by Dr. J. A. Rodler, Montreal, Canada; L. P. Dands, London, England; K. Eastman, of Kansas City, Mo., and others.

BREWERY REFRIGERATION.

THERE is no more any doubt that the production of artificial refrigeration is of the utmost importance in the brewing industry, and that even in localities where natural ice can be obtained at a minimum cost, the advantages of artificial refrigeration are so great as to justify the larger expenditure, says a German technical journal. We therefore find refrigerating machines in use even in Sweden and Norway, and the most northern parts of Europe, where ice is plentiful. The advantages of artificial refrigeration consist partly in the convenient and more uniform distribution of temperature and, in what seems to be of far more importance, the greater purity of the air in cellars cooled by artificial refrigeration. The beer cellars cooled with natural ice do not admit of the exchange of the cellar air; and the opening of the cellar windows, in the warmer seasons, is either very hard to manage, or in some cases entirely impossible. The natural ice, which is usually piled up at the ends of the cellar, prevents a rapid adjustment of the temperature, so that the most scrupulous care must be exercised, to prevent admission of outside air. When the cellar is kept cool by artificial refrigeration, this exchange of air, which is so important, can be easily managed with very little extra cost. The value of artificial refrigeration has been most clearly demonstrated in our fermenting cellars. As I am superintending two breweries, in one of which natural ice is used, while the other is operated with artificial refrigeration, I have daily opportunity to study the advantage of artificial and the disadvantages of natural refrigeration, which latter appear even with the most careful and scrupulous manipulation. Besides the circumstance already mentioned, that with artificial production of coolness, the exchange and amelioration of the cellar air becomes possible and very easy to effect, I found by the tension of the air in artificially refrigerated cellars, that the existing miasma, films, etc., do not multiply and propagate to such an extent as in cellars refrigerated with natural ice.

The reasons, therefore, have to be sought in the stronger tension of the inner cellar air, which does not permit the bad air to rise from the cellar channels or even from the flooring, as is the case in cellars with natural ice, as well as in the impurity of the natural ice used for refrigerating purposes. Pettenkofer, the great scientist, has, in his highly interesting investigations of the important hygienic question of cellar residences, made known some important facts which deserve well to be studied by brewers. Pettenkofer's discoveries show us clearly how easily the process of deterioration of the air goes on, and how difficult it is to collect and retain good air in cellars. The circulation of air surpasses all ideas which are formed by those who have not made it a study, and this may be the reason for the fact that the question of ventilation is still far from being satisfactorily solved. The quality of natural ice, which by most brewers receives very little attention, is such that a lot of bacteria are conveyed in it to the cellars, where the conditions are most favorable to their development. Even moderately careful brewers who are not indifferent to the origin of their natural ice, and supply their breweries with crystal clear ice, cut from flowing water, do not know what disadvantages and consequent damages are carried to the cellars with the ice.

If, for instance, the ice is taken from the river Danube (not from a small by-river of that stream), which generally comes in large and crystal-clear blocks, and this is melted, the water, if analyzed, will be found to contain all the filth which the river water had taken up. Whoever has seen a drop of such water under the microscope will not be astonished if he learns that such water or ice, if used in the cellars or even in the swimmers of the fermenting vats, for cooling, can do considerable mischief. But how much worse is it, when the ice used for such purposes is taken from the foul waters of the Vienna (or in the vicinity of the Chicago river), from the ponds of brickyards, from marshes and moors, where frogs, toads, salamanders and other disgusting amphibia are, so to speak, cultivated. That such ice is used is nevertheless a fact, particularly in those breweries where "saving" is spelled with a big "S," and in which the buying is done by inexperienced business men, who drive the practical brewer to madness when he finds that his fermentation and the whole quality of his beer is spoiled on account of ill-placed "economy." Then the "economical" business manager at his desk will clear himself of all responsibility, and shove it on the heavy shoulders of the brewmaster, who neglected to inquire into the origin of the natural ice, which the business man had bought so "cheap."

Besides all these advantages of artificial refrigeration, there is one other circumstance that deserves attention. It is the fact that on the pipe coiling running along the ceiling of the cellar there will be formed a crust of ice (looking like fine snow) which will take up and make innoxious the bad miasma of the cellar air, and greatly diminish the offensive bacteria. We see, therefore, that artificial refrigeration has advantages which can never be obtained by natural ice. May the price of ice machines soon become such that even the smaller breweries will be able to introduce artificial refrigeration in all departments.

ICY ITEMS.

——Ed. Mitchell has sold his ice business at Lansford, Pa., to a Mr. Cook, of Tamaqua.

——M. Gerber has purchased the ice trade and property of O. D. Kuhns at Atchison, Kan.

——Hillis & Browning have succeeded Hillis & Garner in the ice business at Greencastle, Ind.

——The T. H. Davis Ice Manufacturing Co., Pomeroy, Ohio, has been incorporated; capital stock, $40,000.

——R. B. Bohannon, formerly of Bakersville, is now manager of the National Ice Co., at Tulare and Visalia, Cal.

——The drivers for Andrews & Fairchild, ice dealers, Chelsea, Boston, Mass., on July 11 presented Mr. L. Fairchild with a gold-headed cane.

——R. T. McDonald has purchased a controlling interest in the Fort Wayne Artificial Ice Co. C. R. Higgins will act as general manager of the business.

——B. F. Crowe having resigned as chief engineer of the West Chester (Pa.) ice factory, Ira Stover, of Waynesboro, Pa., has been appointed to the position.

——The schooner Mina Belle, which was loaded July 20, at the Katahdin ice house, Bangor, by T. J. Stewart & Co., took to Port of Spain, Trinidad, 650 tons of ice.

——The Washington (Ohio) Ice Co. has sunk a new well, which promises to furnish an abundant supply of pure water for ice making. The well is eighty feet deep, and flows freely at the surface.

——The Crystal Ice and Cold Storage Co.'s new plant at Davenport, Iowa, was opened to the public July 1. The usual display of fancy pieces were made and shown the 500 or more vistors who called.

——The directors of the McKeesport and Youghiogheny Ice Co. on July 1 elected E. C. Converse, president; R. G. Wood and A. Inskeep, vice-presidents; and Capt. John F. Davitt, secretary and treasurer.

HISTORY OF THE THERMOMETER.

THE invention of the thermometer marks an epoch in science, for it alone has permitted of obtaining a knowledge of the laws that govern calorific phenomena. The first idea of it is, perhaps, due to the celebrated Van Helmont, who devised an apparatus which, to use his words, was "to prove that the water contained in a bulb attached to a hollow rod rises or descends according to the temperature of the surrounding medium."

In the seventeenth century the necessity of an apparatus adapted for measuring the differences of the temperature was so greatly felt that Galileo, Bacon, Scarpi, Fludd, Borelli and other scientists of the epoch devoted themselves in this direction to researches that were not always crowned with success. It is not till 1621 that we find a beginning of the solution in the experiments of a Dutchman, Cornelius Van Drebbel. This physicist's thermometer consisted of a tube filled with air, closed at its upper extremity and dipping at its other extremity (which was open) in a bottle containing nitric acid diluted with water. According as the external temperature rose or fell, the air in the tube increased or diminished in volume, and consequently the liquid descended or rose.

This instrument, called the *calendare vitrum* (indicating glass) by its inventor, constituted what has since been called an air thermometer, but as its graduation was based upon no definite principle, it was incapable of furnishing any comparable reading.

Along about 1650 the members of the Accademia del Cimento, at Florence, introduced into the thermometer certain improvements that gave it nearly the form that it has to-day; and its principle was based upon the expansion of liquids. The tube was filled with colored alcohol. In order to graduate it, it was taken to a cellar and the place was marked where the liquid came to a rest. Then, starting from this, the portions situated above and below the mark were divided into 100 equal parts. As may be seen, it was impossible with such a system to construct two instruments that should agree. Nevertheless, it was the only apparatus that was made use of for half a century.

Finally, in the latter part of the seventeenth century, the physicist Renaldini, of Pisa, a professor at Padua, proposed that all thermometers should take the freezing degree of water as a fixed point, and, as a second fixed point, that to which alcohol rises in a tube dipping in melted butter, the intervening space to be divided into equal parts.

From this epoch, then, dates the present thermometer, and the first instrument due to this innovation dates back to 1701. This was constructed by Newton, and was the first thermometer giving comparable readings that had been devised. The liquid that he adopted was linseed oil, which is capable of supporting a higher temperature than alcohol without boiling, and his fixed point of graduation for the upper limit was the heat of the human body, and for the lower, the point at which the oil stops at the moment of its congelation.

A search soon began to be made for a thermometric agent other than oil (which was too feebly expanded by heat and which congeals at but a slightly elevated temperature), and in 1714, Gabriel Fahrenheit, of Dantzig, almost completely solved the problem in the construction of the thermometer that now bears his name. This was immediately adopted in Germany and England (where it is still employed), and was introduced into France. But along about 1730, scientists gave preference to the one that Reaumur had just devised.

Finally, in 1741, Celsius, a professor at Upsal, constructed the instrument called the Centigrade thermometer.

The three last-named instruments are the ones most commonly used, and differ only in the graduation of each.—*La Science en Famille.*

TEST OF ICE MACHINES.

IT is understood that the four ice and refrigerating machines now running at the World's Fair will be subjected to a competitive test of power and production, such test to take place about August 15th.

The details of the tests ICE AND REFRIGERATION has been unable to procure; but we are informed that they will be made under the direction and supervision of Prof. J. E. Denton, of Stevens Institute of Technology, Hoboken, N. J., a gentleman who, as the trade know, has conducted several tests of this character in the past. We understand that Mr. McMahan, of New Orleans, will also be a member of the committee. Further than these names, we are unable to announce the membership of the committee or jury.

The machines in operation on the Fair grounds are "De la Vergne," New York, and "Linde" (F. W. Wolf & Co.), Chicago, compression; Henderson, Thoens & Gerdes, New Orleans, absorption, and the carbonic-anhydride machine cooling the Krupp pavilion.

Such information as is possible to obtain of the results of these tests will be published in subsequent issues of ICE AND REFRIGERATION.

NEW COLD STORAGE PLANTS.

WORK in this direction appears to have been well concluded for the time being, owing to the lateness of the season. Our record for the month is as follows:

ILLINOIS.

Chicago.—The Consumers' Ice Co. at Thirty-fifth and Butler streets, are fitting up three stories of their building above the ice tank for cold storage, which will give them 450,000 cubic feet of space. They will use direct expansion. The company is now operating four machines of a combined ice making capacity of 240 tons daily. They will go into the general cold storage business, for which they have a fine location.

PENNSYLVANIA.

Meadville.—The Leon C. Magaw Cheese Co. have just erected a large cold storage plant. It is three stories high, built under the Dexter patents, and is specially adapted for handling the butter and cheese of the sixteen large factories belonging to the company. The cheese is held for curing at 60°, according to the English standard, and then run into the refrigerating rooms. The butter is held frozen, and other rooms for fruit, eggs, etc., are arranged with proper temperatures. The railway track runs along one side of the house, where suitable receiving and shipping rooms are provided. The building and equipments are complete in every respect, insuring the company the best results obtainable from modern improvements. The company has the following officers: President, A. M. Fuller; treasurer, John J. Shryock; manager, Leon C. Magaw; secretary, J. J. Magaw.

TEXAS.

Brenham—Reichardt, Becker & Co. are erecting a cold storage plant.

Port Lavaca—A. L. Canfield, whose ice factory has been in successful operation since February last, is now putting in a cold storage addition to the plant. It will be of special value to the fishing trade, which is developing rapidly.

WASHINGTON.

Seattle.—The Diamond Ice and Storage Co. have put in the block system of ice making of the plans by Lea Pusey, of Wilmington, Del. The steam ice cutter, the company say, is a perfect success, cutting ice six feet in depth by eleven inches thick in six minutes.

A WORLD'S FAIR EXHIBIT.

AMONG the interesting and instructive exhibits in Machinery hall, at the World's Columbian Exposition, Chicago, is that made by the Stilwell-Bierce & Smith-Vaile Co., of Dayton, Ohio, herewith illustrated. It embraces Victor turbines of both "register gate" and "cylinder gate" patterns, arranged on both vertical and horizontal shafts, and ought not to be overlooked by any who are using or contemplating the use of water power. These celebrated turbines are built in such a great variety of styles and sizes as to meet the requirements of almost any situation.

Another very interesting feature of the exhibit are the Stilwell "open" and "close" heaters and the live steam purifier for heating and purifying feed water for steam boilers. The practical efficiency of these heaters is demonstrated by a display of lime deposits taken from heaters in operation in various sections of country. The proper treatment of feed water is an item of great moment in designing an economical steam power plant, and should be carefully investigated.

This exhibit also contains a display of "Smith-Vaile" steam pumps in great variety of styles and for every duty, thus increasing the practical value of the exhibit to all visitors who are making investigations along these lines.

At the ice making plant of Messrs. Henderson, Thoens & Gerdes, in the rear of the World's Fair boiler house, described in the July issue of this journal, Messrs. Sauls Bros., of Columbus, Ga., have as an exhibit one of their automatic ice can fillers in actual operation, The galvanized iron ice cans in use in the same plant constitute the exhibit of A. H. Pierce Manufacturing Co., Chicago.

——Ice has begun moving out of Rockport, Me., in good quantity by schooner.

——W. W. Scott has begun foreclosure proceedings against the Saddle River Ice Co., Paterson, N. J., on a mortgage for $12,000 on the real estate of the company executed several years ago, now owned by Geo. A. Hobart.

NEW CORPORATIONS.

THE following new companies have been licensed to incorporate during the past month. Where further information concerning them is known by ICE AND REFRIGERATION, notice is made in the regular departments:

ICE COMPANIES.

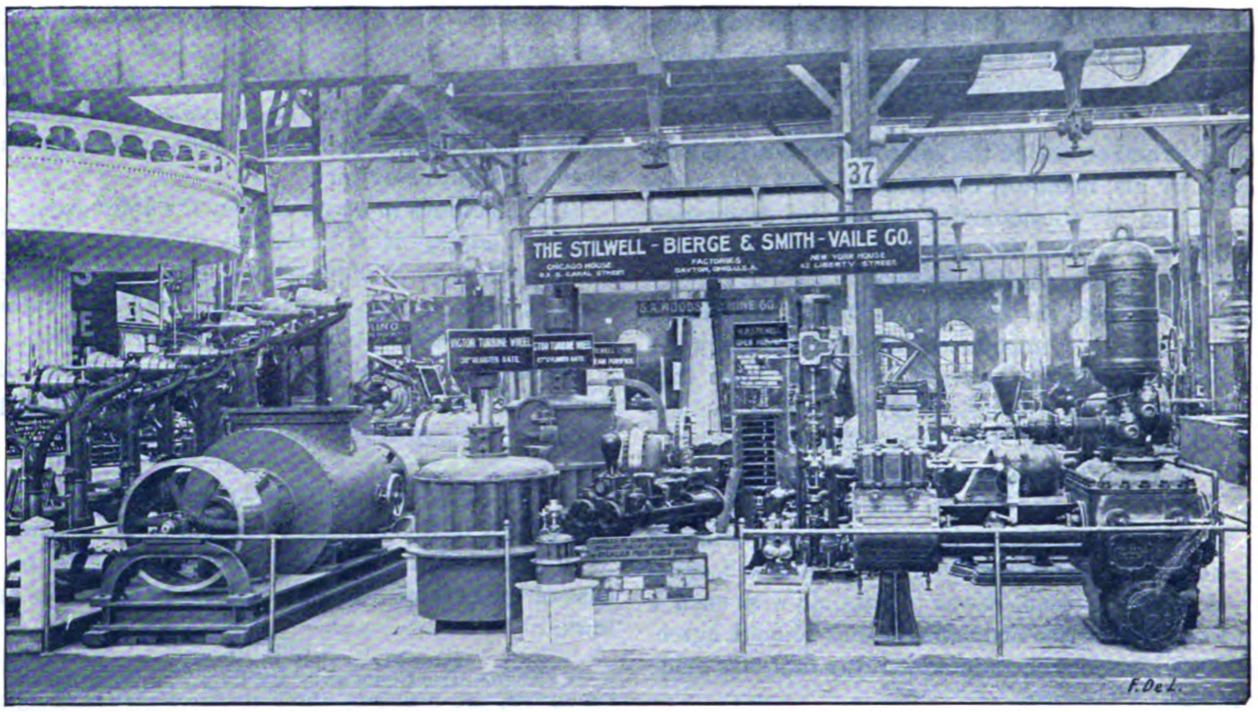
——Garden City Ice Co., Chicago; $25,000.
——Dorchester Hygeia Ice Co., Boston; $60,000.
——New Consumers' Ice Co., New Orleans; $400,000.
——Crystal Ice Co., Pittsburgh and Allegheny; $150,000.
——Ice and Cold Storage Co., Greentown, Ohio; $3,000.

CREAMERIES.

——Jenera Creamery Co., Jenera, Ohio; $5,000.
——Felver Creamery Co., Marshall, Ill.; $10,000.
——Mendota Creamery Co., Mendota, Ill.; $6,000.
——Hamler Creamery Co., Hamler, Ohio; $5,000.
——The Prairie Creamery, Rockwell, Iowa; $5,000.
——Lafayette Creamery Co., Lafayette, Iowa; $6,000.
——Hartland Cheese and Butter Co., Hartland, Wis.; $5,000.
——Bear Valley Butter and Cheese Co., Bear Valley, Minn.; $5,000.
——Owen Centre Creamery Association, Owen Centre, Iowa; $5,000.
——Montrose Separator Creamery Co., Montrose, S. D.; $10,000.

MISCELLANEOUS COMPANIES.

——Keokuk Poultry Co., Keokuk, Iowa; $10,000.
——Pacific Packing Co., Portland, Ore.; $50,000.
——Washington Butcher Co., Camden, N. J.; $50,000.
——Warren Cold Storage Co., Warren, Ohio; $75,000.
——Richmond Produce Exchange, Richmond, Va.: $10,000.
——Jewell Refrigerator Manufacturing Co., St. Louis; $30,000.
——Sandusky Cold Storage and Commission Co., Sandusky, Ohio; $15,000.



WORLD'S FAIR—EXHIBIT OF THE STILWELL-BIERCE & SMITH-VAILE CO.

DOING THE RIGHT THING.

YOUNG MAN—"I deliver ice at your house, and I thought I'd see if you wouldn't do the right thing by me in the purchase of a ring for a young woman."

JEWELER—"How high do you want to go?"

YOUNG MAN—"About $8."

JEWELER—"You deliver ice at my house, you say?"

YOUNG MAN—"Yes."

JEWELER—"Well, there's a six-dollar ring, but under the circumstances you may have it for $8."—*Judge.*

IN THE LIGHTER VEIN.

SEASONABLE POETRY OF MACHINE TYPE—THE FRESH SUPPLY BEAR CO., A STUDY IN COLD STORAGE AND ITS REMARKABLE RESULTS.

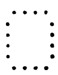
THE SEASONS.

ICE MAN:

How charming is the summer time,
It fills my soul with bliss,
For every customer now takes
A piece of ice like this:

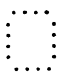
COAL MAN:

How dreadful is the summer time,
I find in it no bliss,
For every customer now takes
A piece of coal like this:



ICE MAN:

How dreadful is the winter time.
I find in it no bliss,
For every customer then takes
A piece of ice like this:



COAL MAN:

How charming is the winter time,
It fills my soul with bliss,
For every customer then takes
A piece of coal like this:

THE MAN WHO BRINGS THE ICE.

The man with the melon is welcome still,
And the man with the cream is nice;
But the mellow fellow who fills the bill
Is the man who brings the ice.

Who drops it there,
In a ten-cent slice,
And cools the air
As he hollers: "Ice!"

His rumbling wagon the children know;
And "Isn't he good and nice?"
They cry, as scampering out they go
For a chat with the man with ice!

Each outstretched hand
Gets a little slice;
O, it's fairy land
When the man brings ice!

The horse that he drives looks wet and cool!
His wagon, of rude device,
The heat divides with its freezing sides,
A-drip from the blocks of ice!

And here and there,
As he saws a slice,
He cools the air
With his "Ice! Ice! Ice!"

So, the man with the melon is welcome still,
And the man with the cream is nice;
But the mellow fellow who fills the bill
Is the man with the daily ice.

Who drops it there,
In a ten-cent slice.
And cools the air
As he hollers: "Ice!"

—*Atlanta Constitution.*

THE FRESH BEAR SUPPLY CO.

A GLOOM seemed to rest upon the usually genial party gathered around the table. Even the vivacious Jackson Peters was somewhat downcast, especially after Jones thwarted him in his attempt to tell of a St. Louis man he had just heard of who recently took first prize in a homing pigeon match by inserting a small rubber tube in the throat of his bird and inflating him with hydrogen gas. Jones indignantly denounced the story as improbable. After this silence settled down upon the group for some time; but when the waiter withdrew, Jones casually observed, "I see the usual summer trouble with the ice men has begun."

"Yes," Robinson returned. "My ice man complains of the expense of having to carry one large piece of ice in his wagon to keep the little ones from melting before he can deliver them to his customers."

"Precisely," answered Jones. "That is the way with ice men. I once knew an ice man in Detroit who presented each of his customers with a volume of Dr. Kane's "Arctic Explorations," and then cut down the size of his pieces of ice 50 per cent. But speaking of ice men, how inadequate, after all, is our vaunted system of cold storage. I speak, gentlemen, *ex cathedra*, having been the originator and president of the Scranton Fresh Bear Supply Co. We raised black bears, and put fresh bear meat on the market in car load lots, whether bears were in season or not. I will tell you about it in a moment."

Jones leaned back in a chair and puffed at his cigar with an air of blended expectation and resignation. At the end of one minute he remarked, simply, "Well?"

"Well, what?" demanded Jackson Peters, sharply.

"We are waiting, Jackson, for the story of an uncle of yours, who invented a canary bird cage, which could be used as a rat trap at night."

"There was never anything of the kind in the family," answered Jackson Peters, with a suspicion of indignation.

"Indeed? I anticipated that a direct reference to black bears would remind you of canary bird cages. But to our story. It was at Scranton, Pa., the state bear headquarters. In fact, Scranton is the wild animal capital of the United States. At no other place are they so intelligent. I was once, eight miles north of Scranton, jostled by two black bears, while a third picked my pocket of a tobacco pouch and sixty cents in change. You may well look interested, Jackson; that is worth remembering. A young man of your age can learn many valuable facts by listening quietly to my conversation. Still, I never had an uncle who invented a folding bed which could be used as a sloop yacht in the daytime, utilizing the sheets for sails, and the space under the mattress for storing the champagne.

"But we did not have to do with the wild bears except to make a beginning. We caught one hundred prime black bears, and started a bear ranch. At the end of four years we had 5,000 head of bear. We began to put them on the market, and the Scranton Supply

Co.'s bear meat became famous in this country and Europe. But we found our profits largely eaten up by several peculiarities of the business. Our bears all became beautifully fat in the fall, but to keep them so, and supply the year-around demand which had sprung up was expensive. We tried raising the price, but the public would not stand it, and many people ceased to buy our meat. We tried cold storage for our bear meat, but this our customers also objected to, demanding absolutely fresh meat. Indeed, local butchers soon came to insist on having the live bear shipped directly to them. When we abandoned cold storage, we found ourselves $50,000 in debt, and with 2,000 fat bears on hand ready for the abattoir, and practically no demand for bear at remunerative prices. I may say, gentlemen, that it was not a good day for b'ar.

"At this juncture the president of the company arose and took complete control of affairs with a firm hand. I think I mentioned the fact that I was the president. I asked for unlimited authority, and the stockholders gave it to me. I turned to the abandoned cold storage warehouse, started up the ice machines, and although it was in June, reduced the temperature inside to five below zero. In the mean time I had procured from the woods around Scranton 2,000 hollow logs. These I placed in the cold-storage warehouse. I then drove in our 2,000 fat bears. They sniffed the air once or twice, growled a little, and began nosing around among the logs. They thought they saw that a hard winter was upon them, and gentlemen, each one of those intelligent animals crawled into a hollow log and began to hibernate. By keeping the temperature at the same low point we found that we could leave a bear there for any length of time we chose—three months, six months, one year, two years—and he would come out as fat and fresh as when he went in. When we got an order from a butcher we could nail a cover over the hole in the log and ship it to him with the bear inside, like a silk hat in a pasteboard box. The butcher could, if he wished, put him in cold storage and keep him still longer. We advertised our bears as 'hibernated at the ranch,' and at the end of two years I retired from the company with $80,000 in cash."

Jones rose, walked firmly to the mantel, and helped himself to a match. The voice of Jackson Peters was heard in the room, as he sniffed the air, and said, "I suppose you lost it raising rabbits to slaughter during the dark of the moon in a convenient cemetery for their left hind feet, eh?"

"Young man, I didn't lose that money at all. I went to Chicago and began the publication of pocket testaments for the Iowa trade. I had strong competition in the Iowa Family Supply Co., but as its testaments held only a pint, while mine would all hold a quart, I got the bulk of the trade, and doubled my money inside of eighteen months."—*By H. C., "Adventures of Jones," in Harper's Weekly.*

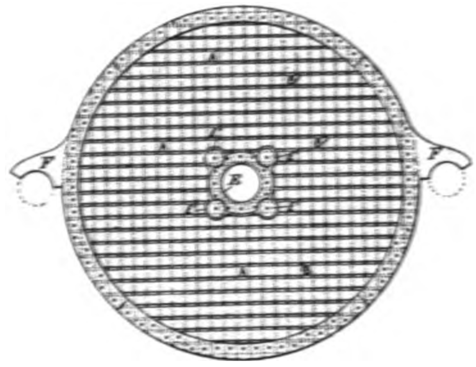
THE Keystone Iron Works at Kansas City, Kan., recently had the luxury of a strike, based on a demand for ice to be furnished by the company, instead of by the men, who had been chipping in to buy it themselves. The company next day began supplying ice, and all is lovely.

We append below the most important new patents relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office of recent dates to June 27, at which time the *Gazette* has ceased to appear, at least temporarily:

PRESSURE FILTER.

No. 499,515. Charles C. Burke, New York, N. Y. Filed February 12, 1893. Serial No. 460,684. Patented June 13, 1893. (No model.)

Claim.—1. The septums for a pressure filter composed of slats closely adjacent to each other, the inter-

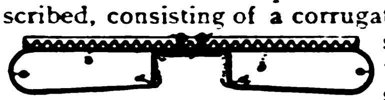


mediate spaces opening out at the edges of the septums, and rims around the outer ends of the slats for holding the slats in their proper relative positions, the surfaces of such rims being flat and equi-distant, in combination with filter canvas or similar material extending out between and clamped by the rims and capable of separation for the removal of the paraffine or other material between the filter canvas substantially as specified.

ICE SUPPORTING RACK FOR REFRIGERATORS.

No. 499,841. George L. Lobsitz, Newark, N. J. Filed February 16, 1893. Serial No. 462,634. Patented June 20, 1893. (No model.)

Claim.—1. The improved ice rack or table herein described, consisting of a corrugated top plate *a*, spring supports *b*, secured thereto, and face plates *l*, secured to said rack or table, said parts being combined and arranged to operate as and for the purposes set forth.

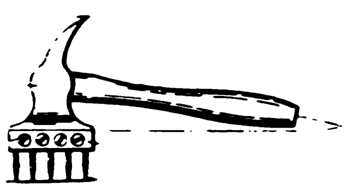


2. An ice rack or table having a series of troughs or receptacles in the top thereof, means whereby said troughs are rendered capable of holding water to their full capacity or depth and means for supporting the troughs, as described and for the purposes set forth.

ICE SPLITTER.

No. 499,286. Cornelius R. Day, Blackstone, Mass. Filed February 4, 1893. Serial No. 460,945. Patented June 13, 1893. (No model.)

Claim.—1. In an ice splitter the head *A* having in one side of the blade a rectanglar recess formed by faces *c* and *d*, the lower face *d* having therein grooves *e* and *f*, in combination with plate *D*, having therein slots *k* and grooves *g* with enlargement *h*, and removable picks *F* formed with flanged heads *l* and flattened and enlarged shanks, substantially as described.



VOL. V. NO. 3. CHICAGO: NEW YORK: SEPTEMBER: 1893. $2.00 PER ANNUM

[*Written for* ICE AND REFRIGERATION.]

ICE MAKING IN YUCATAN.

THE CHOCOLATE FACTORY AND ICE MAKING PLANT OF SENOR LUIS MORALES, AT MERIDA DE YUCATAN—AMERICAN MACHINERY IN USE.

World wrongly called the New! this clime was old
When first the Spaniard came in search of gold.
Age after age their shadowy wings had spread,
And man was born and gathered to the dead;
Cities rose, ruled, dwindled to decay,
Empires were formed, then darkly swept away;
Race followed race, like clouds shades o'er the field,
The stranger still to strangers doomed to yield.—*Anon.*

"WE sailed at hazard toward that part of the horizon where the sun set," wrote that busy chronicler, Bernal Diaz, telling of the approach of the Spanish fleet under Cordova to the shores of Yucatan, in the year of grace 1517. This coast had been seen before by Europeans, but to Cordova must be given the honor of having opened the way for its acquisition by the Spaniards. The latter found the natives intelligent, clothed in the same curiously woven and colored cotton coverlets and tunics they wear to-day, and that though armed only with "long pointed swords with channels on each side the blade, edged with sharp flints that cut the body as well as steel," the warriors they encountered were no insignificant enemy. The Yucatecos were, in fact, the first natives of the new world to shed European blood, and though the Spaniards after 1517 were constantly fighting them, it was only after twenty years of struggle that they finally conquered, being the victors in the great battle of T'ho (Merida), in 1540. Then the Spaniards found that this country, so desperately battled for, so heroically defended, so rich in ruined cities whose birth was so far back "in the twilight of time" that there is not even a tradition to tell who built them, contained not a single mine of gold or silver, nor anything they prized, to reward them for their conquest—only rich lands which needed simply the touch of a hand guided by brains to produce abundantly. The Spaniards held the land, however, and the people quickly embraced the religion of their conquerors, and settled down to the quiet cultivation of the arts of peace, as the only road to wealth and contentment, and have so continued to this day.

SENOR DON MIGUEL MORALES,
Merida, Yucatan.

Merida, the capital city, was built by the Spaniards about the middle of the sixteenth century, on the ruins of the ancient Indian city of T'ho; and it has to this day preserved to an unusual degree its ancient characteristics. Its population of 55,000 to 60,000 is made up of full-blood whites, the beautiful, kindly and lovable Mestizos, and native Indians, who have made the surrounding plantations a garden, in the midst of which is the charming city itself. Merida is twenty-one miles from its port Progreso, the two cities being connected by a railway which is considered one of the most profitable railroad lines in the world. Progreso is not an ideal harbor, but it serves, and through it from Merida passes all the commerce of this ancient land of Yucatan.

Into this interesting capital city of this ancient and mysterious land has penetrated the ice machine as a connecting link between the ever present past, which is so conspicuous in all Spanish-American lands, and the

(2)

busy, matter-of-fact present, which jostles the past everywhere in that south-land, which needs only the presence of more men of energy and brains to become one of the richest sections of our wonderful American hemisphere.

The ice factory located at Merida was erected in connection with the chocolate factory of Senor Luis Morales, the plant having been installed in the spring of 1889. The building, which is herewith illustrated, is 40x90 feet in size, in the characteristic style of the per-

FACRICAS DE CHOCOLATE Y DE HIELO DE LUIS MORALES.
Merida, Yucatan.

manent architecture of the tropics, the offices and salesroom being in that corner of the building which is the central figure of our picture. The chocolate factory is in the extreme rear on the left, as shown by the picture. The refrigerating machinery is an "Arctic" machine, built by the old Arctic company, now the Arctic Machine Co., of Cleveland, Ohio, the installation of which is shown by the interior view herewith of the factory. The machine is rated at ten tons, but will make twelve tons of ice daily, and also refrigerate the chocolate factory. Ice is made by the "can" system, in blocks of 175 pounds each, which is sold at one and one-half cents per pound. The wells on the premises furnish an abundant and cheap water supply, but the cost of fuel is very high, ranging from $14 to $15 per ton at Merida.

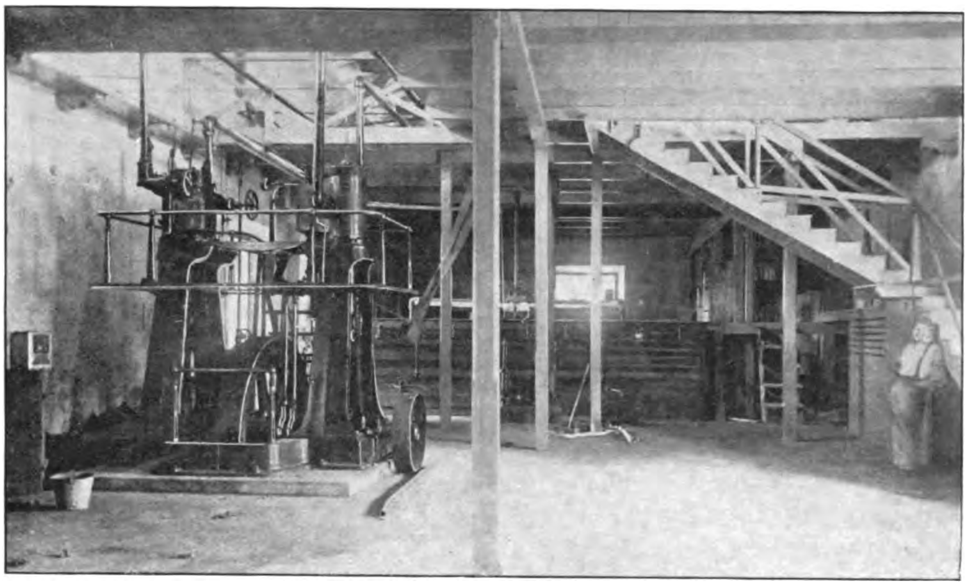
SENOR LUIS MORALES.

Senor Morales, the proprietor of their plant, is one of the progressive and solid business men of the state of Yucatan. His business interests extend to all parts of the state, and are particularly conspicuous at Merida and Progreso, where he has large warehouses and offices. Senor Don Manuel Morales, whose portrait we give herewith, is a native of Yucatan, a brother of the proprietor. He was formerly in the commission business at Progreso, but gave up that line to become manager of the plant under consideration.

Mr. Eugene C. Gaeckley, whose portrait also we are pleased to present to our readers, is a native of France, but came to the United States in 1850, and became a citizen. He was for eighteen years connected with the old Arctic Ice Machine Manufacturing Co., of Cleveland, as foreman and erecting engineer, and is well known in this country, where previous to 1889 he had erected "Arctic" machines in all parts of the country. When he had finished the erection of this machine for Senor Morales in Merida, he was induced to remain there to take charge of all the machinery in the establishment, and he has as yet had no cause to regret his choice then made.

The proprietor, Senor Luis Morales, designing to enlarge his plant at Merida, Senor Don Miguel Morales and Mr. Goeckley recently made a visit to America, taking in, of course, the great Columbian Exposition. Their time in the United States was largely given, however, to the study of improved methods and appliances for the production of ice and chocolate. It was at that time the editor personally made the acquaintance of these gentlemen, and we can assure our readers who are proud of the trade and jealous for its prestige, that our friends in Yucatan will always be found in the front rank of "the hustlers."

THE Washington papers late in July announced a movement on foot among the managers of the Great Falls, Independent, American and Washington Consolidated Ice companies to consolidate the interests of the various companies in one organization. The appraisers are said now to be at work, the property to be examined being the local holdings as well as real estate, franchises, etc., on the Penobscot and Kennebec rivers. It is understood that T. A. Lambert, of the Great Falls Ice Co., will be president of the new corporation. The officers of the Hygienic Ice Co. (manufacturers), say their company is in no way involved.



FABRICAS DE CHOCOLATE Y DE HIELO DE LUIS MORALES—INTERIOR, SHOWING TEN-TON ARCTIC MACHINE.
Merida de Yucatan.

THE IMPURE ICE QUESTION.

THE health officer at Sioux City had announced that he was going to "get after" a certain unnamed dealer in ice, who is delivering ice formerly stored in the Silberhorn Packing Co.'s ice houses, which ice, he said, has been in storage for several seasons and was originally cut from a slough formed by back water from a local river, and it is full of dirt and refuse from the packing houses, and very unhealthy. He had not yet properly examined the ice when these statements were made, but "everything goes" with officers *talking* about ice. As to acting—"well, that's different"; for a few days after the above programme was outlined to a reporter, we are informed that "the health officer says that the reason he does not take immediate steps in suppressing the sale of inferior ice instead of referring the matter to the council is that the ice dealers in question have 6,000 tons of ice in their house, which they value at least at $1 per ton. He does not want to be responsible for closing this house and thereby take chances of being made defendant in a $6,000 damage suit. He wants the council to back him up in the matter." In other words, he guesses that the ice is bad, but doesn't really know anything about it!

ASSISTANT Sanitary Superintendent Waring, of Kansas City, Mo., has delivered himself as to ice, and he is quoted as saying that "the chief danger from artificial ice is that it may contain ammonia, which is used in manufacturing it." This sage observation might be made chapter I of a very large book which the sanitary department of Kansas City might write on "What We Don't Know about Ice." He also calls attention to a local ordinance "against the selling of Missouri river ice here for any but refrigerating purposes. Every wagon that peddles such ice must announce the fact in big letters on its sides, and there is a fine for selling it for family use."

THE sensational papers of St. Louis are still trying to keep that city in a ferment by shouting the "terrible" dangers of impure ice, and a month ago it was announced that every dealer's ice would be examined. So far only one analysis has been reported (and that has not been noted in the sensational sheets), that of the East St. Louis Ice and Cold Storage Co.'s ice, which has been found absolutely pure.

AN English correspondent of the *Butchers' Advocate* says that the English butchers have formed an organization "to protect their customers (!) against United States beef." It is claimed that American beef is branded "prime Wiltshire" and "best Waterford," and that buyers are thereby deceived into believing it home raised meat. This irregular "branding" is, of course, a very wicked proceeding, but not so bad, in a certain way, after all, if it is true, as has been said, that the English consumers, not experts, cannot tell the difference! The English butcher is also anxious to protect his customers from the gross impropriety of eating New Zealand mutton, which he is likewise unable to distinguish from prime native. But after all, when American beef and New Zealand mutton can be sold in London and Liverpool at a lower price than the home grown meat, the problem the native meat grower has to meet is a difficult one.

EUGENE C. GAECKLEY.
Merida, Yucatan.

THIS is the very latest: "The labor saving tendency of modern science was strikingly illustrated during a recent hunting expedition to the hills of Neweria Ellia, in northern Ceylon. The heat was intense, and no springs could be discovered; but at the next upland brook one of the guests produced a couple of small bottles and a tin cup with a double bottom, and in less than five minutes manufactured a 10-ounce lump of solid ice—sufficient to reduce a gallon of lukewarm water to the temperature of ice cold lemonade." We have all heard of the "slaves of the lamp and of the ring," but this is the first time we have heard of this type of "slaves of bottle."

HERE is still "another one": "A practical mechanic in Collinsville has had in use for several years a perfect substitute for an ice box. It is simply a dumb waiter from the dining room to the cellar bottom, in which a boot box on end with portable shelves slides down into the earth four or five feet, a wooden casing being provided for it, and rope, pulley and weight for counterbalance. Temperature 60°, making butter so hard that it cannot be spread."

ANOTHER source of fresh foreign meat supply for Great Britain is about to be opened in Bulgaria, a cargo of dressed meat having been shipped by sea from Bourgas to London. The steamer is a Cunarder, and is furnished with refrigerating apparatus. It is thought that the trade promises well.

THE Cook county (Chicago) grand jury concluded its work by no bills of indictment against the parties held by the coroner's jury of the Hercules Iron Works World's Fair fire. This, of course, exonerates Messrs. McDonald and Skinner, of the Hercules Iron Works, as well as Director of Works Burnham and Marshal Murphy.

ICE IN MIDWAY.

On Greenland's icy mountains,
The Frost King holds his throne,
And rules imperial o'er the year
Within the frigid zone;
But Rankin's Ice King holds his court,
And rules the torrid day
Where burning suns, with all their wrath,
Bow down to Rankin's sway.

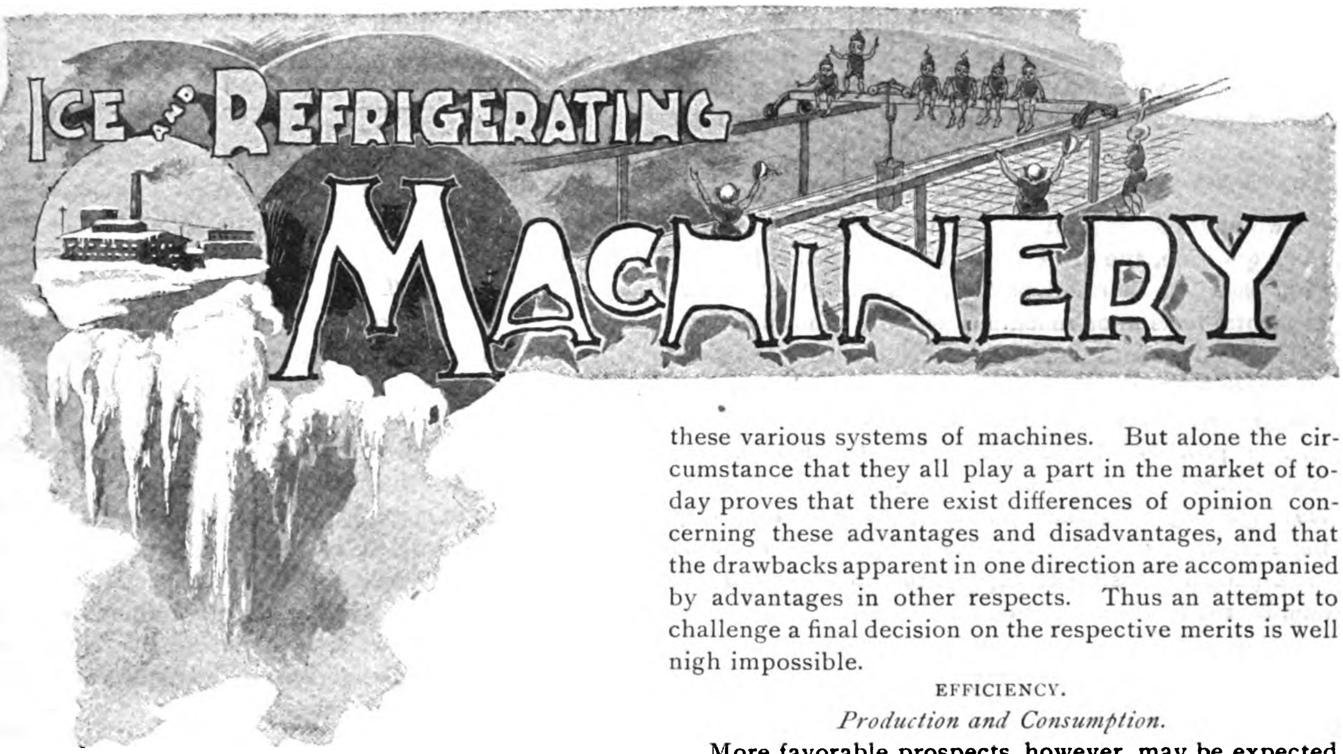
THE above "pome" of "flowing verse" is handed down to posterity by a belated copy of a circular issued some twenty years ago by a Cincinnati house, who were then advertising one of Thomas L. Rankin's earlier inventions in refrigeration. Mr. Rankin has been a "refrigerator" from "'way back," so to speak; that is, he is one of the pioneers of this great industry, than which, as Prof. Linde tells us elsewhere in this issue, "hardly any branch of modern industry is able to show such rapid development." In the light of Mr. Rankin's latest inventive achievement, materialized, in conjunction with the DeLa Vergne refrigerating machine, in the "Ice Railway" on Midway Plaisance, World's Fair, the doggerel verse quoted assumes the dignity of a prophecy, for it is to-day literally true that the artificial (?) ice king does "rule the torrid day."

In the May number of ICE AND REFRIGERATION was published a description of this novel and interesting idea in refrigeration, born and developed in the brain of Mr. Rankin; and herewith we give a photographic view of the scene presented every day now on Midway where, with a torrid sun shining overhead, the sleighs are ready to start up the incline and down the hill on their exhilarating and refreshing slide over 900 feet of "real snow and ice." The face of Mr. Rankin, the inventor, is shown in the position occupying the seat in front on the left, and holding his hat in his hand, while Col. Distin, the manager, is shown on the right of the seat next back, and Mr. Thompson, the builder and inventor of the cable grip in use, is standing on the left of the sleighs.

Midway is a very "large place," with its Ferris wheel, alongside of the Ice Railway, and its heterogeneous population of strange peoples and customs from all countries and corners of the earth; but it is fair to say that while the the strange races have gratified the curiosity of the millions who have seen Midway, the two great mechanical triumphs which stand side by side—the Ice Railway and the Ferris wheel—have divided among themselves the honors as the most distinguished and unique sights of the entire Exposition.

WORLD'S COLUMBIAN EXPOSITION—VIEW OF LOADED SLEIGHS ON ICE RAILWAY IN THE MIDWAY PLAISANCE.

THE first symptoms of sunstroke are dizziness, then things "look green," after which the blood vessels of the brain dilate and unconsciousness soon results. The dangers of treatment come from collapse, which sometimes results from a sudden application of ice to the vital parts. Then brandy and atropine must be given until there is a revival. The chief preventives are to be found in the selection of airy bedrooms, for most cases occur in bed at night, strange as this may seem. In speaking of its treatment a surgeon says: "We at once strip the patient of all clothing and place him on a wire mattress, and freely sprinkle the body with ice water, after which, in several cases, we place ice bags on the head and over the region of the heart. In such cases the temperature runs from 101 to 110, and the pulse from 110 to 130 or 140, and the chief point is to reduce these. We give bromide of sodium until the quantity of blood in the head is lessened and reduced to a normal condition. The patient must be kept quiet, for there is a tendency to delirium."



[*Reprinted from* ADVANCE SHEETS.]

THE REFRIGERATING MACHINE OF TO-DAY.*

GREAT INCREASE RECENTLY IN REFRIGERATING MACHINES—DIFFICULTY OF REACHING A FINAL DECISION ON THEIR MERITS.

BY C. LINDE, MUNICH, GERMANY.

ON reviewing the development of the refrigerating machine within the last ten years, a notable feature will be found to be the increase in their number. Considerable as was the number of cooling machines in use in 1883, it represents only a relatively modest figure when compared with the imposing number of machines set to work during the decade now expired. Entire fields of industry have been laid open to the employment of refrigeration, and, apart from technical electricity, hardly any other branch of modern industry is able to show such rapid development. There can be no doubt that during this time there have been noteworthy improvements in the construction of refrigerating machinery and important novelties in the methods of applying cold for the most diversified purposes. But no methods new in principle have appeared, and also no striking discoveries or inventions which might have furnished new lines for the production of cold. We stand in a time of elaboration of the foundations laid in previous decades.

The cold air and absorption machines having thus been in existence for more than three decades, the ammonia compression machine during two, and the youngest member of the series of industrially important machines—the carbonic acid machine—being beyond the first decade since its introduction,† it will not be questioned that the initial development of these machines has been attained long ago, as they have been executed partly in thousands, or at least in hundreds, of instances, and thus have proved themselves thoroughly serviceable. Opportunities cannot have been wanting for forming an opinion concerning the advantages and drawbacks of these various systems of machines. But alone the circumstance that they all play a part in the market of to-day proves that there exist differences of opinion concerning these advantages and disadvantages, and that the drawbacks apparent in one direction are accompanied by advantages in other respects. Thus an attempt to challenge a final decision on the respective merits is well nigh impossible.

EFFICIENCY.

Production and Consumption.

More favorable prospects, however, may be expected from the solution of the problem when it is so chosen that it is limited to certain questions, permitting a precise and analytically defined expression; for instance, the question of efficiency is such a one—that is to say, the relation between the quantity of cold produced and the expenditure of mechanical work (or heat) and of cooling water.

None of the classes of refrigerating machines which have been mentioned are to-day individual property. Any manufacturer is at liberty to construct absorption machines or to adopt sulphurous acid, ammonia or carbonic acid for a compression machine. A correct answer to the question of the influence which various methods of working and the selection of the working agents exert upon the efficiency may consequently be presumed to meet with universal interest.

If it be attempted in the following lines to raise a discussion on this subject, such an endeavor is made with the knowledge that also this question will not find a final answer in its entire extent, but within certain limits only.

It may be preassumed as generally acknowledged that the cold air machine in point of efficiency is considerably surpassed by other groups.* The two follow-

* Presented at the Chicago meeting (August, 1893) of the American Society of Mechanical Engineers, and forming part of volume XIV of the *Transactions*.

† The carbonic acid ice making machine constructed for F. Krupp, at Essen, in 1882 by the Maschinenfabrik Augsburg on lines furnished by the author, will have to be considered as the first installation of this kind.

* For confirmation the following results obtained from various cold air machines are appended, which should be compared with the corresponding column of table I, given farther on:

ACTUAL PERFORMANCE OF COLD AIR MACHINES.

SYSTEM	Bell-Colem'n.	Lightfoot.	Haslam.
TEST NO.	1	2	3
Diameter of compression cylinder	28"	27" s'gle-act'g	25¼" two-cylndr
Diameter of expansion cylinder	21"	22"	19⅛" two-cylndr
Diameter of steam cylinder	21"	....	20" H. P. 31⅛" L.P.
Stroke of all cylinders	24"	18"	36"
Revolutions per minute	63.2	62	72
Air pressure in receiver, lbs. (absolute)	61	65	64
Temperature of air entering the compression cylinder	65½° F.	52° F.	....
Temperature of air after expansion	—52.6° F.	— 82° F.	— 85° F.
I. H. P in compression cylinder	124.5	43.1	346.4
I. H. P. in expansion cylinder	58.5	28.0	176.2
I. H. P. in steam cylinder	84.4	24.6	332.7
B. T. U. abstracted per hour and I. H. P. of steam cylinder at 20° F.	668	1,554	954

The figures for test No. 1 have been observed and published by Professor Schroeter (*Untersuchungen an Kaltemaschinen verschiedener Systeme*, Munich, 1887); those for No. 2 are published in minutes *Proc. Inst. Mech. Eng.*, London, 1881. The data for trial No. 3 are taken from a paper read last year before the Manchester Society of Engineers.

ing questions will, however, be replied to variously: What is the relation between the absorption and the compression cycle, and what influence upon a compression machine is exerted by the use of sulphurous acid, of ammonia or of carbonic acid?

ABSORPTION AND COMPRESSION.

Two methods present themselves for the treatment of this question, the one consisting of theoretical calculation based on thermodynamics, and the other on experimental tests upon machines actually constructed.

Thermodynamics enable us to calculate for the various systems of machines with full certainty the *maximum efficiency* which can be reached by a certain definite working process. Experimental investigation affords, on the other hand, the only reliable proof in how far the *actual efficiency* falls short of this maximum for every single machine system. For the compression machine it is especially possible to express this theoretical maximum by the familiar * formula:

$$\frac{Q}{AL} = \frac{T}{T_c - T} \qquad (1)†$$

For the comparison of efficiency between a compression and an absorption machine (which latter is not acted upon by external mechanical work, but by heat), it is necessary to place alongside the absorption machine a combination of a compression machine and a heat engine (for instance, a steam engine). If u be the ratio between the equivalent of mechanical work AL and the quantity of heat Q', which must be imparted to the motor to produce the work L, we write:

$$\frac{AL}{Q'} = u, \text{ and obtain:}$$

$$\frac{Q'}{Q} = \frac{T_c - T}{uT} \qquad (2)$$

It follows, as a result, that the expenditure of heat Q' necessary for the production of the quantity of cold Q in a compression machine will be the smaller the smaller the difference of temperature $T_c - T$ will be, and that both values possess the limiting value o.

How far does this apply to the absorption machine? Let the working process be assumed to be performed without any losses, and let the cycle of one pound of ammonia‡ be considered, then there will be produced in the refrigerator a quantity of cold Q equal to the latent heat r less the heat of liquid $(q_c - q)$ brought by the ammonia from the condenser into the refrigerator. The heat Q' to be supplied to the still is composed of the heat of absorption $s_c = r_c + a_c$ and the specific heat of the ammonia which has been heated from the absorber temperature (t_a) to the temperature of the still (t').

We find, therefore (neglecting the work of the liquor pump and any water which may participate in the cycle):*

$$\frac{Q'}{Q} = \frac{r_c + a_c + c(t' - t_c)}{r - (q_c - q)} \qquad (3)$$

If we allow the range of temperatures to be reduced to an infinitely small amount in order to obtain Q' as small as possible as compared with Q, we find as limiting value—

$$\left(\frac{Q'}{Q}\right)_0 = \frac{r + a}{r} > 1$$

In contrast to the limiting value o for compression machines we find here a value > 1, from which results that, at any rate between certain limits of temperatures, the compression principle will hold out indications of a higher efficiency than the absorption principle.

In how far this really applies for the *actual efficiency* can only be determined from the results of quite reliable tests and measurements. It will be especially a case of proving whether the *actual efficiencies* hitherto obtained from compression machines do not already within certain limits surpass the *theoretical maximum limit* of the efficiency of the absorption machines.

It is now intended to be demonstrated that such is the case.

The most favorable results known to the author of such trials (the carrying out of which gives full assurance of reliability) are here appended; they belong to an ammonia compression machine.†

TABLE I.

AMMONIA COMPRESSION MACHINE.

Actual Results Obtained at the Munich Tests.‡

No. of Test		1	2	3	4	5
Temperature of refrigerated brine.§	Inlet, deg. F.	43.194	28.344	13.952	−0.279	28.251
	Outlet, t deg. F.	37.054	22.885	8.771	−5.879	23.072
Specific heat of brine (per unit of volume)		0.8608	0.8508	0.8427	0.8374	0.8508
Quality of brine circulated per hour cu. ft		1,039.38	908.84	633.89	414.98	800.93
Cold produced, B. T. U. per hour		342,909	263,950	172,776	121.474	220,284
Temperature of cooling water in condenser.	Inlet, deg. F.	48.832	49.476	48.931	49.098	49.235
	Outlet, t_c dg. F.	66.724	68.013	67.282	67.267	93.366
Quantity of cooling water per hour in cu ft		338.76	260.83	187.506	139.99	97.76
Heat eliminated by condenser, B. T. U. per hour		378,358	301,404	214,796	158,926	271,134
I. H. P. in compressor cylinder		13.82	14.29	13.53	11.98	19.75
I. H. P. in steam engine cylinder		15.80	16.47	15.28	14.24	21.61
Consumption of steam per hour in lbs		311.51	335.98	305.87	278.79	430.14
Cold produced per hour, B. T. U.	Per I. H. P. in comp cyl.	24,813	18,471	12,770	10,140	11,151
	Per I. H. P. in steam cyl	21,703	16,026	11,307	8,530	10,194
	Per lb of steam	1.100.8	785.6	564.9	435.82	512.12
$e = \frac{Q}{AL_e} + \frac{t_c - t}{460 + t}$ ‖		0.548	0.635	0.606	0.585	0.616
$\frac{Q}{Q'}$ = cold produc'd ÷ heat expnd'd		0.970	0.708	0.509	0.393	0.462

* It should be stated that also in this last decade individual attempts have not been wanting which denied the general validity of the "second law" of thermodynamics on which this equation is founded, or which endeavored to interpret this law in a misleading manner. The "second law" is, however, so firmly upheld in its truth by all experts that the refutation actually established by experiment was hardly necessary to repel such efforts.

† The formula expresses: The theoretical maximum of heat abstracted (produced cold) stands to the thermal equivalent of the mechanical work to be expended in the same ratio as the (absolute) temperature for the heat abstraction bears to the difference between this temperature and the temperature for the heat rejection.

‡ Only such absorption machines will be here considered, which work with ammonia and water, as other absorption machines do not to-day possess any practical importance.

* Thus we consider $t_a - t_c$ (the a and c being read as subscript—hard to indicate in so small a type).

† The trials here referred to were carried out in the month of May of the present year in the "Testing Station of Refrigerating Machines" of the "Polytechnische Verein" at Munich by a committee of this society. This committee is composed of five professors of mechanical engineering holding chairs in five of the German technical high schools, one member being Dr. Zeuner), of two professors of physical science, one chemist and others. The director and reporter is Professor Schroeter, of Munich. It is a matter of regret that hitherto manufacturers of compression machines only have availed themselves of the opportunity of an exact investigation of their apparatus; there have been tested several ammonia compression machines and one sulphurous acid machine.

‡ *Vide Bayerisches Industrie und Gewerbeblatt*, Munich, 1893 [e is substituted for Greek eta].

§ The specific gravity of the brine (a solution of chloride of calcium in water) was 1.249 at 63.5° F. for all tests.

‖ In the calculation of e, *i. e.*, the ratio between the actual efficiency $\frac{Q}{AL_e}$ and the theoretical maximum efficiency $\frac{Q}{AL} = \frac{460 + t}{t_c - t}$, the actual work expended upon the refrigerating machine (L_e) has been taken equal to the indicated work in steam engine reduced by 1.2 I. H. P., *i. e.*, the indicated work of steam engine running empty (without compressor).

The motor was here a small single cylinder condensing steam engine (diameter, 11", stroke 27½"), for which the mean value of u was determined at $u = 0.114$.

For a more powerful compound steam engine with a value of $u = 0.158$, corresponding to modern attainments in steam engine practice, *i. e.*, fourteen pounds steam per hour and I. H. P., the efficiencies will result:

TABLE I*a*.

AMMONIA COMPRESSION MACHINE.

Actual Performance, Assuming a Compound Steam Engine as Motor.

No. of Test	1	2	3	4	5
$\frac{Q}{Q'}$ = cold produced ÷ heat expended	1.362	1.001	0.713	0.533	0.637

To enable a comparison of these values with the theoretical maximum efficiency of an absorption machine, we have to substitute in equation (3) the values corresponding to the temperatures between which the tests Nos. 1–5 have been carried out.

In this manner the following maximum values* for $\frac{Q}{Q'}$ are obtained (*i. e.*, for the performance of an absorption machine without reference to any losses, also not to the work of the liquor pump and of water entrained by the ammonia):

TABLE II.

AMMONIA ABSORPTION MACHINE.

No. of Corresponding (Munich) Test	1	2	3	4	5
Corresponding temperature t deg. F	37	23	8	−6	23
Corresponding temperature t_c	68	68	68	68	95
Theoretical maximum efficiency $\frac{Q}{Q'}$ =	0.534	0.527	0.522	0.516	0.493

A comparison of Tables I and I*a* with Table II demonstrates:

(1) The actual efficiency of the ammonia compression machine investigated at Munich is, for the tests Nos. 1 and 2, higher than the theoretical efficiency obtainable from an absorption machine working without loss.

(2) The actual efficiency of the ammonia compression machine is also higher in trials Nos. 3, 4 and 5, if a compound steam engine be assumed as motor, the steam consumption of which amounts to fourteen pounds of steam per I. H. P. per hour.†

For a better survey of these results the following Table III has been compiled, giving values for the respective ratios of actual efficiencies of the compression machine to the theoretical maximum of efficiency of the absorption machine:

* In conformity with the conclusions arrived at by Ledoux and by Denton (*Trans. Amer. Soc. Mech. Engrs.* Vol. X), the heat of absorption is here taken uniformly at 925.7 B. T. U.

† As regards the actual efficiency of the absorption machine, it appears, according to the information at present available, not to exceed 50 per cent of the maximum efficiency. Professor Schroeter (*Untersuchungen an Kaltemaschinen*, Munich, 1887), has found for $t = 12°$ F., and an inlet temperature of the cooling water of about 50° F. in testing three different absorption machines (neglecting work of liquor pumps), $\frac{Q}{Q'} = 0.17, 0.23$, and 0.25; if the steam necessary to work the pumps and agitators be included, about 0.10, 0.145, and 0.15 respectively.

F. E. Denton (*Trans. Amer. Soc. of Mech. Eng.*, Vol. X, page 792), has found for $t = 16°$ F. an initial temperature of the cooling water of 54° F., and an outlet temperature of 80° F.: $\frac{Q}{Q'} = 0.30$ without steam for liquor pump, and 0.26 including this steam.

TABLE III.

No. of Test		1	2	3	4	5
Temperature of cooling water leaving condenser, deg. F		68	68	68	68	95
Final temperature of refrigerated brine, deg. F		37	23	8	−6	23
Actual efficiency of compression machine ÷ theoretical maximum efficiency of absorption machine.	Ac'ord. to Table I.	1.816	1.398	0.977	0.762	0.937
	Accord'g to Table I*a*	2.551	1.899	1.368	1.033	1.292

Although it may be gathered from the foregoing as being exceedingly probable that, for all temperatures important for practice, the actual efficiency of ammonia compression machines of good construction will be superior to that of absorption machines, it will only be held that the following has been proved:

With ammonia compression machines actual efficiencies have been obtained which, within temperature ranges $t_c - t \leqq 75°$ *F.* [*that is the difference of temperatures between the outgoing cooling water* (t_c) *and the final brine temperature* (t)], *surpass the efficiencies obtainable by absorption machines, even if it were possible for them to perform the cycle without loss of any kind.*

Within these ranges of temperature no alterations or improvements of the absorption machine will enable it to produce the same quantities of cold with an expenditure of heat sufficing for an ammonia compression machine like that recently tested at Munich.

SULPHUROUS ACID, AMMONIA OR CARBONIC ACID?

The theoretical maximum of efficiency for a compression machine is (according to formula 1) independent of the working fluid. Hence any differences in this efficiency observable in the action of different fluids, can only be attributed to losses of work and heat.

EXPANSION FROM CONDENSER TO REFRIGERATOR.

Formula 1 refers to the "complete" (Carnot) cycle, which is composed of two isothermals and two adiabatics.

It is, however, well known that the compressors perform only three of these four "perfect" processes, while for the fourth process, *i. e.*, the adiabatical expansion from the condenser temperature to the refrigerator temperature, a direct injection of the liquid is substituted whereby heat of liquid is imparted to the refrigerator, so that per pound of the fluid only the heat $r - (q_c - q)$ is abstracted from the body to be cooled. It is evident that the loss thus caused will be the greater, the greater the liquid heat of the working substance will be relatively to its latent heat. Table IV demonstrates in this respect the behavior of the three industrially important fluids of the present day.

TABLE IV.

		Sulph'rus Acid.			Ammonia.			Carbonic Acid.		
t_c * deg. F.	t deg. F.	Latent heat† r	Heat of liq'id $q_c - q$	Loss in efficiency x	Latent heat. r	Heat of liq'id $q_c - q$	Loss in efficiency x	Latent heat. r	Heat of liq'id $q_c - q$	Loss in efficiency x
	32	164.16	7.32	0.0171	566.75	18.98	0.0181	102.35	17.60	0.0983
50	14	168.19	13.49	.0411	577.47	36.45	.0349	115.70	32.09	.1813
	−4	171.00	18.50	.0618	586.51	52.41	.0507	126.79	44.51	.2426
	32	164.16	15.79	.0522	566.75	39.46	.0387	102.35	40.86	.2843
68	14	168.19	21.96	.0758	577.47	56.93	.0565	115.70	55.35	.3646
	−4	171.00	26.97	.0972	586.51	72.89	.0735	126.79	67.77	.4252
	32	164.16	25.41	.0888	566.75	61.45	.0652	102.35	84.44	.7834
86	14	168.19	31.58	.1146	577.47	78.92	.0813	115.70	98.93	.8311
	−4	171.00	42.76	.1380	586.51	94.88	.0993	126.79	111.35	.8662

* Hereby it is assumed that the fluid will reach the expansion value possessing the temperature t_c [x is substituted for Greek letter Xi].

† The figures for latent heat and heat of liquid are taken from Zeuner's tables for sulphurous acid and ammonia, and from Schroeter's table for carbonic acid.

Every third column indicates the loss in efficiency x,* *i. e.*, of that part of the refrigerating effect due to the imperfection of the working process referred to, on the assumption that the compressor will aspirate dry vapor possessing the temperature of the refrigerator.

The unfavorable relation of the heat of liquid to latent heat for carbonic acid explains why the efficiency of the carbonic acid machine falls behind that of the ammonia machine increasingly with greater divergence of the temperatures. At a temperature of about 60° F. for the liquid (reaching the expansion valve) the one single loss of efficiency, x, in a carbonic acid machine amounts to about one-third of the entire maximum efficiency, while the actual efficiency of the ammonia machine tested at Munich shows (according to the second last column of table I) the sum of *all* losses whatsoever not to exceed this amount. If the temperature of liquid attains 88° F., every useful effect derived from the evaporation of carbonic acid ceases, because the liquid heat imparted from the condenser to the refrigerator is then sufficiently great to neutralize the entire heat of evaporation.†

It has been attempted to reduce the loss of efficiency, x, by inserting a "feed cylinder" between condenser and refrigerator for the purpose of performing the adiabatic expansive process. Hitherto such endeavors have not been attended by success. But in the event even of the existing obstacles being surmounted (notably those arising from variations in the ranges of temperature), it should be clearly understood that, by this expansion process, at best only a part of the theoretically available work will be recovered, and that, for the condition of t_c approaching the critical temperature, the feed cylinder will, at the close of expansion, contain only a very small quantity of liquid carbonic acid in consequence of by far the greater part having been vaporized. Hence the vapors aspirated by the compressor originate for the smaller part only in the refrigerator having been principally formed in the feed cylinder. The compressor capacity having to correspond to the volume of the vapors generated both in the feed cylinder and refrigerator, it follows that its size, as well as that of the feed cylinder, will demand a very considerable enlargement.

Another device for diminishing the loss of efficiency x consists in allowing the liquid during its flow to expand primarily from the condenser pressure to an intermediate pressure, whereupon the vapors hereby developed are returned by an auxiliary compressor to the condenser. The remaining liquid is subsequently introduced into the refrigerator in the ordinary way.

It is, however, plain, firstly, that in this manner the harmful influence of the relatively great heat of liquid can be balanced only partly, and secondly, that these means will prove entirely useless when the initial temperature of the cooling water approaches the critical temperature.*

Besides the caloric loss in efficiency just dealt with, quite a series of other well known losses occur in compression machines; they result partly from an interchange of heat with the surfaces of the cylinders, influence of the clearance spaces, leakages through pistons and valves, losses of pressure arising from internal resistance (especially by valve throttling), and are caused partly by external resistances (friction).

[TO BE CONCLUDED.]

* Calculated from *Technische Thermodynamik*, by Dr. G. Zeuner, page 462.

* The actual presence of these conditions at a temperature of 88° F., *i. e.*, at the critical temperature for carbonic acid, can be proved by the following:

The total heat λ for saturated vapors is, for a higher temperature t_c, greater than for a lower temperature t. As $\lambda = q + r$ there will be $q_c - q > r - r_c$. If the higher temperature t_c be now raised to the critical temperature t_k, for which the latent heat is = 0, we find:

$$q_k - q > r$$

Close to the critical point $q_k - q$ is very near to r; the further the temperatures t_k and t will be separated, the smaller the value r becomes as compared with $q_k - q$.

* The unfavorable consequences for the performance of the carbonic acid machine near the critical point, as they result from the physical facts just referred to, have been frequently denied, and cases have been pointed out in which such machines actually work with higher temperatures of cooling water. The explanation of the apparent contradiction is, firstly, that often the final temperature of the cooling water (which exceeds the critical point) is kept in view, while its initial temperature is the determining feature for the present consideration; secondly, that admittedly it is possible to abstract a relatively small amount of heat also in the case of the initial temperature exceeding the critical temperature by maintaining a refrigerator pressure far below that corresponding to the temperature at which heat is to be abstracted from the body to be cooled. From what has been said above, no heat can then be eliminated by evaporation, but it is possible for the vapors of very low temperature, in passing through the refrigerator coils, to take up a certain (specific) heat. The refrigerative performance of the machine is then based on the same principle as that of a cold air machine (with closed cycle).

† *Untersuchungen an Kältemaschinen*, Munich, 1887, pp. 117–139; *Vergleichende Versuche an Kältemaschinen*, Munich, 1890, pp. 65–79.

EFFECTS OF HEAT ON CANNED GOODS.

In a recent army circular Adjutant General Williams repeats the information heretofore published concerning the keeping qualities of canned foods under exposure to extremes of heat and cold. General Greeley, the Arctic explorer, says:

"Apples, peaches, pears, rhubarb, green peas, green corn, onions, potatoes and tomatoes were all subject (at Lady Franklin bay) to extreme temperatures (over 60° below zero), and were solid for months at a time. The second summer they thawed, the following winter froze solid again. All the articles named presented the same appearance as though freshly canned, and their flavor was as good when the last can was eaten as in the first month. It should be understood that these were first-class canned goods, and from dealers of standing and reliability. Cranberry sauce, preserved damsons, preserved peaches and fruit butters suffered certain changes from candying, etc., which detracted somewhat from their flavor, though not materially so. Dealers in such preserves predicted that such conditions and changes would occur. I had also canned turnips, squash, beets and carrots, as well as pineapples, cherries, grapes, clams, shrimps and crabs, which, although not subjected to such extreme temperatures as the foregoing, yet froze and thawed repeatedly without injury. No can of any kind except a few, say half a dozen of fruit butters, was ever burst by action of cold or heat."

Dr. Simson Pratt, of the British army, says:

"Taking my experience in India and the late Nile expedition, in which the test of tinned provisions was exceptionally severe, from continued exposure to the powerful direct rays of the sun, I have found that tinned provisions, meat and vegetables, put up separately, or combined in the form of soups, are practically undamageable by any climatic heat. The only class of provisions that, in my experience, suffers from great heat is that of uncooked articles, such as butter, cheese and some forms of potted meats."

[*Written for* ICE AND REFRIGERATION.]

COMMERCIAL EFFICIENCY.

IMPORTANCE OF SURFACE IN REFRIGERATION—THE INFLUENCE OF PIPING ON THE EFFICIENCY OF REFRIGERATING MACHINES—REMARKS ON TESTING MACHINES.

BY GEORGE RICHMOND, M. E.

THE term "efficiency" is made to do duty for such a large variety of ideas and relations that some confusion can hardly fail to result from its use. In addition to the meanings in common use, already cited, another, which may be termed "commercial efficiency," requires to be noticed.

When a certain work is to be performed, the machine which will do this work with the least expenditure of power is the one which possesses the highest commercial efficiency. For example, suppose water is to be raised a height of 100 feet, the minimum amount of work to be done by any machine is evidently 100 foot-pounds for each pound of water raised. Two machines are offered, which we will name *A* and *B*, of which *A* requires the expenditure of 150 foot-pounds of work, while *B* requires 160 foot-pounds of work. Provided the price of each machine is the same, the purchaser would have no hesitation in choosing the first of these; and he would say, with some show of reason, that no mechanical expert could be of any use to him in making a choice; he would himself buy the *A* machine and recommend it to his friends, and it would seem that there was really no place for the *B* machine in the market. A mechanic, however, with an itching for investigation, comes along, examines the two machines, and discovers the fact that by a faulty arrangement of piping the *B* machine is actually raising the water 130 feet. This fact, while it in no way affects the commercial efficiency of the two machines, is one, the knowledge of which might have been of value to the purchaser if he had had less implicit faith in his commercial judgment. Indeed, it would seem that he was justified in supposing that each manufacturer would do the best within his power; nor need any sympathy be wasted on the manufacturer of the *B* machine. Nevertheless, the position now is that whereas the *A* machine wastes fifty foot-pounds for every 100 of useful work done, the *B* machine wastes thirty for every 130, or less than twenty-four for every 100; so that by a simple alteration of the piping the *B* machine would perform the same work with 124 foot-pounds that the *A* machine does with 150 foot-pounds.

This simple illustration shows that while the commercial efficiency of a machine is a very important matter, the real efficiency should not be ignored; and this is peculiarly the case in dealing with refrigerating machinery, since a slight alteration of the conditions of running, or proportion of parts, is sufficient to make a machine of superior real efficiency show quite an inferior commercial efficiency.

Fortunately we need not theorize on this matter, but may go directly to experimental results. Quoting from a series of tests made at the testing station at Munich, and reprinted in English units in *Engineering* for August 28, 1891, we find that two machines (which we will distinguish as *A* and *B*) were used to do precisely the same work. In each case the brine came in at the same temperature, 28.4°, and left at 23°, while the conditions of the condensers were precisely the same, namely: Inlet at 49° and outlet at 67°. The duty to be performed then was the lifting of heat from 23° to 67°, and the number of the thermal units which one horse power could theoretically raise through this range is—

$$\frac{460 + 23}{67 - 23} \times 2545$$

Now, as a matter of fact, the *A* machine lifted 7,770 thermal units per horse power per hour, while the *B* machine lifted 7,015. In the absence of any other information, would a purchaser hesitate in selecting his machine? The *A* machine does 11 per cent more refrigeration per horse power (or what amounts to the same thing per ton of coal) than the *B* machine. For a 100-ton plant this would probably amount to from 200 to 300 tons of coal per annum, and a man could very well afford to pay a considerably higher price for the *A* machine, and that without requiring the assistance of an expert. In this case, we do not need to call in this badly abused person, since the facts are before us; and what are these facts? Simply that the *A* and *B* machines are identical, having the same engine, the same compressor, built by the same maker, *and differ only in the fact that the A machine has twice as much piping in the refrigerator as the B machine.* By reason of this fact while the *A* machine works with a difference of temperature between the ammonia and the brine of about 4°, the *B* machine has to maintain a difference of more than 9°; in other words, while the actual range through which the heat must be lifted is $67 - 23 = 44$, the *B* machine actually lifts it through $70 - 14 = 56$, while the *A* machine lifts it only through $70 - 19 = 51$. The work done is not proportional to the respective ranges of lift, as in the case of water, for an examination of the diagram will show that when the temperature of the ammonia is reduced, not only is the work increased, but the refrigeration is reduced by an equivalent amount.

If instead of being satisfied with the statement of relative commercial efficiency represented by the numbers 7,770 and 7,015, we should have investigated the real efficiencies of the two machines, these would have been found to be very nearly the same, and we should have discovered that the discrepancy was not due to the machine itself—the engine and compressor—but should have looked for the cause in the inefficiency of the piping, which might arise either from insufficient quantity or defective circulation. But if we are given simply the numbers 7,770 and 7,015 without data enough to enable us to determine the real efficiency, then we have indeed some very useful information, quite enough, in fact, for a salesman, but hardly sufficient for an intelligent purchaser.

The high commercial efficiency of the better class of refrigeration machines is largely due to ample pipe surface and the intelligent arrangement of it. The cheapening of a machine by reducing the piping, which is the most common method, is a costly one for the user. The data before us will illustrate this. In the present case the adding of 685 square feet of surface resulted in an addition of refrigeration to the amount of 13,745 T. U. per hour, the work done by the engine being unaltered.

This is about twenty T. U. per foot on the average; and as there are 8,760 hours in the year, the extra refrigeration, without cost, for one square foot of surface

amounts to 20×8,760 ÷ 142=1,234 pounds of ice per annum. It is easy to calculate the cost of a square foot of pipe surface, and the value of a ton of refrigeration. In ten years, in this case, each square foot would have earned more than six tons of refrigeration. If instead of increasing the surface by 100 per cent at one jump, the addition had been, say by ten steps of 10 per cent each time, it would have been found that each square foot of the first 10 per cent addition would have had an earning capacity several times 20 T.U. per hour, while each square foot in the last 10 per cent addition would have had a lesser earning capacity. It is not difficult, therefore, to determine the maximum surface of piping the purchaser can afford to pay for; that is, which will yield a profit on the investment. This also should be the minimum amount insisted on by the manufacturers, since with less than this his machine cannot do itself full justice. When, however, the purchaser looks only at the first cost, and is willing to forego a proper test of his machine, he can always find parties ready to assist him in cutting his own throat.

Considering the extreme elasticity of the term efficiency, it seems hardly worth while to quarrel about its use; nevertheless on this point turn nearly all the differences of opinion of investigators. We find it cropping up in experimental work on steam engines; and the same controversy appears in a paper read by Professor Linde, at the congress of mechanical engineers held last month in Chicago. Professor Linde contends for the paramount importance of the commercial efficiency as determining the relative value of a machine, and criticises with some severity the practice of Professor Denton in comparing machines by their real efficiency. There is something to be said for both, and there are difficulties peculiar to each method, which render necessary some amount of compromise, and we are not interested in the controversy further than that it tends to bring out these points in strong relief. What we ask in every case is reliable data; we can then treat it by this method or that, according as we wish to bring out some particular truth. Now for published data on refrigeration we are in a great measure dependent on the work done under the direction of either Professor Linde or Professor Denton, and it would be very unfortunate if our confidence in their work should be shaken by apparent disagreement between these authorities. For this reason, therefore, we have been at some pains to make clear the nature of the controversy, which resolves itself into a method of handling data, and does not affect the accuracy of the data. It is not a question as to which is right or wrong, for each method has its proper place, and there is left no room for the argument that because experts differ in their methods of presenting the subject, the *principles* of mechanical refrigeration are uncertain, or are not well understood.

In the report on the tests above referred to there are a number of other results bearing on the same questions, which are given below:

Refrigeration in T. U. per horse power per hour, shortest possible lift...	23° to 67°.		−6° to 67°.	
A........................	7,770	6,132	4,103	2,789
B........................	7,015	5,638	3,771	2,370

The first and third columns refer to a Linde machine, the second and fourth columns to a Pictet machine. The work to be done in the first instance was to remove heat at 23° and discharge it at 67°; in the second case to remove heat at −6° and discharge it at 67°. The *A* and *B* machines were identical, with the exception that the refrigerator of *A* had double the surface of that of *B*. The actual lift, or range of temperature, of course, was greater than that noted, but in consequence of the extra piping in the *A* machine the actual range was shortened some 5° or 6°. With these facts in mind, this table is very instructive. It is clear that the fact of shortening the range, or raising the refrigerator temperature, or back pressure, resulted in a notable increase in refrigeration per horse power. We notice also that when the brine had to be cooled at —6° instead of 23°, the production in the case of a Linde machine was reduced nearly one-half, and in the case of the Pictet machine more than one-half.* If any one is inclined to doubt the teaching of theory in this respect, such experiments ought to be conclusive. That such doubt really exists is evident from the following, transcribed from a trade catalogue published quite recently:

"Others maintain a high expansion or back pressure to force the pump to handle more gas, all of which is a fallacy. . . . The idea of forcing more work from pumps because of carrying a high back pressure is the very worst form of thermodynamics . . . ; the higher the back pressure the higher the temperature in the expansion coils, and consequently the less heat-absorbing power." The facts of the case are further brought out in the table forming part of Prof. Linde's paper, which will in all probability be reprinted for the benefit of readers of ICE AND REFRIGERATION. Referring to table 1, the condenser temperatures on the first four tests were pretty nearly the same. The brine temperature in the refrigerator, and the corresponding refrigeration per horse power, is given in the extract printed below, the temperature in the condenser being practically the same in each case:

No. of Test.	1	2	3	4
Temp. of brine (outlet)	37	22.9	8.7	−5.9
Cold per I. H. P. of compressor..........	21,703	16,026	10,841	8,530

OBITUARY.

——John B. Messenger, of Natick, Mass., died of diphtheria, on August 22. He was born in 1825, and was for some years in the ice business at Natick.

——The steamship *Umatilla*, of the Pacific Coast S. S. Co.'s line, has just been equipped with a refrigerating plant, including a Vulcan refrigerating and ice machine, by the Vulcan Iron Works, of San Francisco. This plant is intended to keep a number of cold storage rooms on board down to the proper temperature for the transportation of fruit, fish and other perishable food produce, and has proved a great success in every particular, it having been found to be a source of considerable profit, in that the shippers of material requiring cold storage are willing to pay an extra price for the privilege of having their materials carried in the cold rooms.

* The relative commercial efficiency of the machines furnished by Linde and Pictet is obtained by comparing the figures of columns 1 and 2 and those of 3 and 4, from which a very marked superiority is shown for the Linde machine. It is a perfectly legitimate and useful proceeding to analyze these data, and compare the real efficiency of each machine; but there can be no doubt in this case that the real efficiency of the Linde machine used was superior to the real efficiency of the Pictet machine, for (1) the friction was less, (2) the loss by reason of the physical properties was less.

[*Adapted for* ICE AND REFRIGERATION.]

REFRIGERATION AND ENGINEERING.

SINKING OF SHAFTS BY CONGELATION AT THE COAL MINES AT AUZIN, FRANCE—DIFFICULTIES ENCOUNTERED BY OTHER SYSTEMS OF SHAFT EXCAVATION.

BY AUGUSTE J. ROSSI, B. S., C. E.

THE method of sinking shafts in water bearing strata first introduced by Mr. Poetsch has been fully described in these columns as applied to specific engineering works. It has been claimed by the partisans of artificial refrigeration that it furnishes the solution of a particularly difficult problem of engineering, and the gradual introduction in their regular practice of this system by the profession has justified the most sanguine hopes. We intend to speak to-day of an enterprise of this nature, which has been contracted for in France by a well known firm for the company of the Auzin coal mine, and which is certainly the most important one of this kind undertaken so far. The firm of Cail & Co., of Paris, has furnished general plans involving the process, and they have been adopted in preference to others intending to use other methods, the work being to proceed as soon as the machinery can be completed and the freezing pipes driven in the ground. A few words recalling briefly in what the Poetsch system consists, in a general manner will not be superfluous for the better understanding of what follows.

The Poetsch method consists essentially in driving outside the circumference of the contemplated shaft to be sunk, and in such a manner as to include in the zone of freezing action a sufficient area of ground beyond this circumference, in order to allow for timbering, lining, excavating, etc., a series of iron pipes, closed at their lower ends, and reaching to the very depth intended to be given to the shaft, or even beyond it. In this system of pipes properly connected together an uncongealable liquid, brought down to a low temperature (zero F., or less) by the action of an appropriate refrigerating machine, is caused to circulate constantly by means of adequate pumps until it has frozen solidly and effectively both the ground in and around the shaft as well as the water permeating it, making of the whole a solid mass which can be readily removed without any furthe interference from the water of the water bearing strata, this water being transformed into ice as these strata are reached, and the shaft itself (either of wood, bricks or stone) being timbered and built as the excavation of the frozen mass proceeds.

In the particular case we speak of it is the intention to sink two shafts at a close proximity from each other, one to be used for the hoisting of the coal from the mine, the other as an air shaft. Their diameter is rather exceptional—that of the hoisting shaft is to be seventeen feet in the clear when finished, and that of the air shaft about twelve feet. Both are to reach the remarkable depth of 300 feet, or more, through ground particularly treacherous.

As already mentioned, plans of an entirely different nature have been submitted to the company, and estimates of the same given, some contemplating to sink the shafts by the ordinary methods known as "Exhaustion Methods," that is by pumping the water which might be met during the operation by means of powerful water pumps; others proposing to adopt the system known under the name of the "Kind-Chaudon" method experimented in Philadelphia, which uses a sort of movable shield of iron, in which the shaft is sunk and lined without exhausting the water from the ground. But the soundings have brought to light the fact that it might prove next to impossible, even by the use of the most powerful pumps, to keep head against the flow of water, and the "Chaudon system" has been considered as rather too dangerous an experiment to resort to for such diameter as seventeen feet, and such depths as 300 feet.

In short, a study of the engineering conditions of the question in all its details has proved a triumph for artificial refrigeration. A consideration of the estimates of all the plans proposed and of the difficulties of the problem has shown that by the Poetsch method results could be obtained "more surely," "more cheaply" and "in the shortest time." The mere mention at this stage that there is involved in this case the question of congealing the enormous quantity of about four tons of water per hour will impress any one with the magnitude of the work contemplated; and still the certainty of success seems to be perfectly insured when we consider the satisfactory results obtained in previous applications of this freezing method described already in these columns. (See ICE AND REFRIGERATION articles on this subject.)

The ground through which the shafts have to be sunk offers no consistency of any kind for a considerable depth, the different layers being either quicksands of the worst kind, of that kind the miners call "running sands," or cretaceous formations of soft "chalk," full of fissures and highly water bearing.

It is intended to drive on the outside circumference of the shafts thirty-six iron tubes about eight inches diameter inside, closed at their lower end and about three feet from center to center.

The two shafts are to be sunk at a distance of 120 feet from center to center. The system of ice machines adopted is that one known as the mechanical compression system, anhydrous liquid ammonia being the volatile liquid intended to be used. The compressors will be of the "Linde type," provided with special devices for injection of oil in the cylinders during compression and its subsequent evacuation and separation. The freezing of the ground is to be carried on simultaneously around and in the two shafts, but as provision for possible and unforeseen difficulties to be encountered during the course of the work, and especially of the uncertainty of the amount of water to be met with in the water bearing strata to be gone through, the dispositions adopted are such that all the cold applied to the operation of congealing the ground around one of the shafts, can be made available in an emergency for the other.

The ammonia ice machines include the usual refrigerator, or expander, and condenser, both being made of a continuous coil iron pipe; but the direct application of the cold generated by the evaporation of the ammonia in the refrigerator could not obviously be advantageously resorted to in this case and the "brine system" has been adopted. The cold generated in the refrigerator under the action of the aspirating and compressing gas pump is to be transmitted to a bath of chloride of calcium in which the refrigerator is immersed. It is intended to carry the temperature of this freezing medium, which is to be circulated through the tubing driven in the ground to the depth of 300 feet, to at least —20° C., about 4° F. The condensers for the compressed ammonia gas are to be cooled by a special circulation of fresh water by means of proper pumps The ice machine is calculated to furnish in ordinary circumstances of speed and running a minimum of 1,000,000 thermal units per hour, with the possibility, in case of emergency, of increasing its capacity 20 per cent, that is, to 1,200,000 thermal units per hour; the steam engines are so constructed as to work with or without condensation.

The steam engine consists of a pair of twin steam cylinders connected on the same fly wheel of a diameter of twenty-one feet, but they can work independently of each other. They give the motion to the ammonia compressors by means of belt and a pulley of a diameter of eighteen feet. These compressors are to be disposed in pairs, a pair of compressors for each steam cylinder, each compressor being provided with its distinct and independent refrigerator and condenser. Thus there will be in fact four refrigerators and four condensers in all, connected with the said four compressors, one compressor of each pair and its attached refrigerator and condenser only being used at a time in normal running, and one steam cylinder for two compressors. In fact, all the different parts of the machinery are in duplicate, in case of accident happening to one set or of sudden necessity taxing the capacity of the machine. The steam cylinders which, as already said, can work with or without condensation, are to be provided with automatic cut-off of the Ridder type.

Each steam cylinder has a diameter of eighteen inches and a stroke of thirty-six inches; it is intended to make forty-five revolutions per minute in normal running. They cut off to one-tenth when steam is to be used with condensation. The normal absolute pressure of the steam is to be sixty-eight pounds per square inch, corresponding to about fifty-four pounds effective. Each steam cylinder is stipulated to show, at the least, in these conditions, an indicated horse power of 100 horse power, or 200 horse power for the two cylinders.

The ammonia cylinders, four in number, are to be disposed by pair, as already said, one steam cylinder for each pair of compressors; they are to have each a diameter of eleven inches and a stroke of seventeen and three-quarters inches, and are expected to make normally fifty-two revolutions per minute.

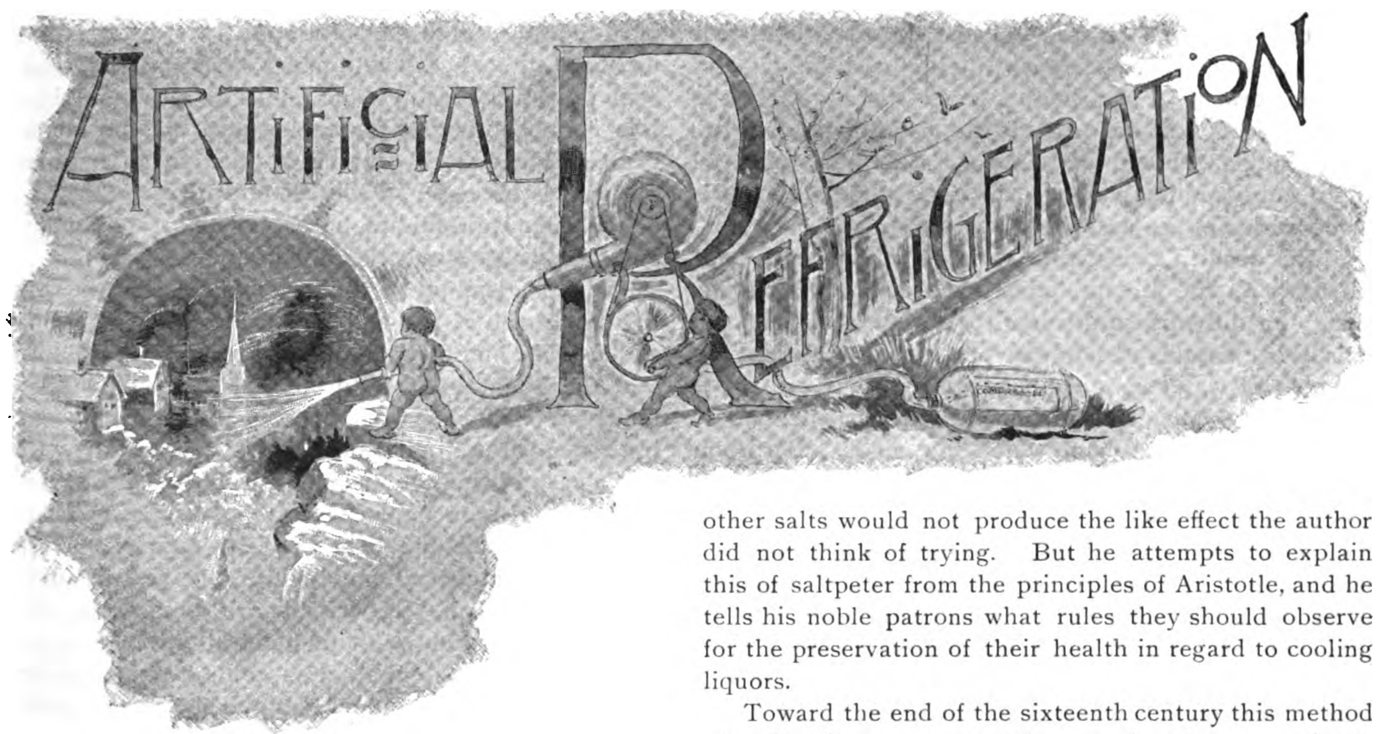
The brine made cold in the refrigerator tank by its contact with the latter, and having reached a temperature of —4° F., is to be pumped through the system of pipes driven in the ground, and then returned to the said tank to be cooled again, after having been warmed up by yielding a part of its cold to the surrounding ground, by means of two steam pumps, one only being in operation at a time, in normal running, the other being kept as a reserve or in case of an accident happening to the first. Their stipulated capacity is to be, for each pump of the pair, 4,200 gallons per hour, or seventy gallons per minute, the diameter of the discharge pipe being eight inches.

The fresh water pumps for the condensing water are to be also steam pumps, built in pair for the same reasons as above, one only acting at a time in ordinary circumstances; their capacity is to be for each of 2,100 gallons per hour or thirty-five gallons per minute, the diameter of the supply pipe being six inches.

The machines are now being built at the Cail & Co. works, and the driving of the iron pipes through the ground is soon to proceed. The whole plant is to be completed and in operation by the end of the year. We expect, from time to time, to be able to furnish further information of details on this work. The difficulties which will have to be encountered seem to be more particularly to be met with in the driving of the tubing, owing to the exceptional depth—300 feet at least.

For sake of comparison with works of the same kind, we mention, in closing, that at the Elmira mine, between Dresden and Berlin, the shaft sunk, when finished, measured only eight feet six inches, and the depth reached did not exceed 124 feet. [See ICE AND REFRIGERATION, Nov., 1891.] At the Chapin mines the shaft was square, about sixteen feet side, but its depth did not reach 100 feet, the greatest length of the tubing being only ninety-seven feet. [See ICE AND REFRIGERATION, Dec., 1891.] The steam engine indicated fifty-five-horse power only.

The icicle of refrigeration around which the tubes were disposed at the Elmira mine had only a diameter of thirteen feet eight inches. In this case the shaft is intended to be seventeen feet in diameter, and, if we assume that the tubing will consist of thirty-six tubes, three feet apart from center to center, as stated, this corresponds to an icicle of refrigeration of 108 to 110 feet circumference, or thirty-four to thirty-five feet in diameter. It is safe to say that this new application of Poetsch method will be made on an unheard-of scale, and, for these reasons, a study of its results will prove highly interesting.



[*Adapted for* ICE AND REFRIGERATION.]

REFRIGERATION IN OLDEN TIMES.

SALTS USED IN COOLING AND FREEZING MIXTURES—DISCUSSIONS RELATING TO THEIR FIRST EMPLOYMENT FOR THIS PURPOSE —ICED DRINKS PREPARED BY OUR ANCESTORS.

(*Continued from August issue, page 102.*)

THE method of cooling liquors by placing them in water in which saltpeter has been dissolved could not have been known to the ancients, because they were unacquainted with that salt. They might, however, have produced the same coolness by other salts which they knew, and which would have had a better effect; but this, as far as I have been able to learn, they never attempted. The above property of saltpeter was first discovered in first half of the sixteenth century, and it was not remarked till a long period afterward that it belongs to other salts also.

The Italians, at any rate, were the first people by whom it was employed, and about the year 1550 all the water, as well as the wine, drank at the table of the great and rich families at Rome, was cooled in this manner. Blasius Villafranca, a Spaniard, who practiced physic in that capital and attended many of the nobility, published, in the before mentioned year, an account of it, in which he asserts, more than once, that he was the first person who had made the discovery publicly known. In his opinion it was occasioned by the remark that salt water in summer was always cooler than fresh water. According to his directions, which are illustrated by a figure, the liquor must be put into a bottle or globular vessel, with a long neck, that it may be held with more convenience, and this vessel must be immersed in another wide one filled with cold water. Saltpeter must then be thrown gradually into the water, and, while it is dissolving, the bottle must be driven round with a quick motion on its axis in one direction.

Villafranca thought that the quantity of saltpeter should be equal to a fourth or fifth part of the water, and he assures us that when again crystallized it may be employed several times for the same use, though this, before that period, had by many been denied. Whether other salts would not produce the like effect the author did not think of trying. But he attempts to explain this of saltpeter from the principles of Aristotle, and he tells his noble patrons what rules they should observe for the preservation of their health in regard to cooling liquors.

Toward the end of the sixteenth century this method of cooling liquors was well known, though no mention is made of it by Scappi, in his book on cookery. Marcus Antonius Zimara, however, speaks of it in his problems. I do not know at what time this Appulian physician lived. In a list of the professors of Padua, his name is to be found under the year 1525, as *explicator philosophiæ ordinariæ;* and because another is named under the year 1532, we have reason to conjecture that he died about that time. But in that case the physician Villafranca would probably have been acquainted with the Proplemata of Zimara; and would not have said that no one had spoken of this use of saltpeter before him. Levinus Lemnius also mentions the art of cooling wine by this method—so much that the teeth can scarcely endure it. We are informed by Bayle that the earliest edition of his work, which has been often reprinted, was published at Antwerp in the year 1539 in octavo. It contains only the two first books, but as the above account occurs in the second book, it must be found in this edition.

Nicolaus Momardes, a Spanish physician, who died about the year 1578, mentions this use of saltpeter likewise. It was invented, as he says, by the galley slaves, but he condemns it as prejudicial to health. From some expressions which he uses I am inclined to think that he was not sufficiently acquainted with it, and that he imagined that the salt itself was put into the liquor. At a later period we find some accounts of it in various books of receipts, such as that written by Mizaldus in 1566, and which was printed for the first time the year following. In the "Mineralogy of Aldrovandi," first printed in 1648, this process is described after Villafranca; but where the editor Bartholomæus Ambrosianus speaks of common salt, he relates that it was usual in countries where fresh water was scarce to make deep pits in the earth, to throw rock salt into them, and to place in them vessels filled with water, in order that it might be cooled. This remark proves that the latter salt was then employed for the same purpose, but it has led the editor into a very gross error. He thinks he can conclude from it that the intention of potters, when they mix common salt with their clay, is not only to render the vessel more

compact, but also to make it more cooling for liquors. But the former only is true. The addition of salt produces in clay, otherwise difficult to be fused, the faintest commencement of vitrification, a cohesion by which the vessel becomes so solid that it can contain fluids, even when unglazed; but for this very reason it would be most improper for cooling, which is promoted by the evaporation of the water that oozes through.

The Jesuit Cabeus, who wrote a voluminous commentary on the Meteorologica of Aristotle, which was ready for the press in the year 1644, assures us that with thirty-five pounds of saltpeter one can not only cool 100 pounds of water by quickly stirring it, but convert it also into solid ice; and for the truth of this assertion he refers to an experiment which he made. Bartholin says that for the above account he can give him full credit, but the truth of it is denied by Duhamel, who suspects that the Jesuit took the shooting crystals of the salt to be ice. As far as I have been able to learn, no one, in latter times, has succeeded in congealing water by saltpeter alone without the help of snow or ice. The powder which a duke of Mantua had, in the middle of the seventeenth century, and by which, as the story goes, water, even in summer, could be instantaneously converted into ice, may without doubt only have been saltpeter. Was this salt, therefore, considered formerly as the cause of the cold in the northeastern and other countries because it was used for cooling liquors? Even at present many farmers will say that such-or-such a field is cold because it is bound with saltpeter.

Who first conceived the idea of mixing snow or ice with saltpeter and other salts, which increases the cold so much that a vessel filled with water, placed in that mixture, is congealed to a solid mass of ice that may be used on the table, I cannot with certainty determine; but I shall mention the earliest account of it that I have been able to find: Satinus Tancredus, a physician and professor at Naples, whose book "De Fame et Siti," was published in 1607, speaks of his experiment and assures us that the cold was so much strengthened by saltpeter that a glass filled with water, when quickly moved in the above mixture, became solid ice. In the year 1626 the well known commentary on the works of Avicenna by Sanct. Sanctorius was published at Venice in folio.

The author in this work relates that in the presence of many spectators he had converted wine into ice, not by a mixture of snow and saltpeter, but of snow and common salt. When the salt was equal to a third part of the snow the cold was three times as strong as when snow was used alone.

Lord Bacon, who died in 1626, says that a new method had been found of bringing snow and ice to such a degree of cold by means of saltpeter as to make water freeze. This he tells us can be done also with common salt, by which it is probable he meant unpurified rock salt; and he adds that in warm countries, where snow was not to be found, people made ice with saltpeter alone, but that he himself had never tried the experiment.

Mr. Boyle, who died in 1691, made experiments with various kinds of salt; and he describes how, by means of salt, a piece of ice may be frozen to another solid body. Descartes says that in his time this was a well known phenomenon, but highly worthy of attention. Since that period the art of making ice has been spoken of in the writings of all philosophers where they treated on heat and cold, and with many other experiments has been introduced into various books of receipts. It was then employed merely for amusement, and no one suspected that it would ever be applied to an important purpose in luxury. In like manner Fugger's first bills of exchange were said to be useful only for gambling, and gunpowder was called a trifling discovery.

In the beginning of the seventeenth century drinking cups made of ice and iced fruits were first brought to the table, but near the end of that century it appears that the French began to congeal in this manner all kinds of palatable juices, which were served up as refreshments at the tables of the great and wealthy. This was a grand invention for the art of cookery, which became common among the German cooks, both male and female, about the middle of the last century; and since that time our confectioners sell single glasses of iced articles to the ladies at our balls and in theaters.

I am acquainted with no older information respecting this invention than what is contained in Barclay's "Argenis," which is, indeed, a romance; but the author's accounts make the possibility of its being used so clear that we may certainly conclude it was then employed; especially as he mentions it several times.

Arsidas finds in the middle of summer, at the table of Juba, fresh apples, one-half of which was encrusted with transparent ice. A basin, also made of ice and filled with wine, was handed to him, and he was informed that to prepare all these things in summer was a new art. Snow was preserved the whole year through in pits lined with straw. Two cups made of copper were placed, one within the other, so as to leave a small space between them, which was filled with water; the cups were then put into a pail, amidst a mixture of snow and unpurified salt coarsely pounded, and the water in three hours was converted into a cup of solid ice, as well formed as if it had come from the hands of a pewterer. In like manner apples just pulled from the tree were covered with a coat of ice.

The first edition of the "Argenis" was printed at Paris in 1621, and in that year the author died at the age of thirty-nine. The book is far from being scarce, but the passage to which I allude is so beautiful that I shall transcribe it to save my readers the trouble of searching for it. After brandy, from being a medicine, came into general use as a liquor at table, and was drank in common by the populace, the Italians above all endeavored to render it weaker and more pleasant by various mixtures, and by raising its value to make it more respectable, and at the same time, more useful to the people of the first rank. That their wares might be distinguished with more certainty, they gave them the name of liquori; and under that appellation sold them to foreign nations. The French were the first who adopted the use of these articles, particularly after the marriage of Henry II, then duke of Orleans, with Catharine de Medici, in the year 1533. This event brought to France great numbers of Italians, who made the French acquainted with these delicacies of their native country, and who taught them to prepare and to use them. They were the first, therefore, who made and sold the fine liqueurs at Paris, and in order to serve those who could not bear heating liquors, or rather to serve themselves, by filling their

pockets with money, their successors in this business invented, about the year 1630 or 1633, the beverage called lemonade, because the juice of lemons or oranges was its chief component part. This liquor soon came into high repute, as it not only served for cooling and refreshing people during the sultry heats of summer, but was even recommended by physicians against putrid diseases.

The limonadiers, or venders of lemonade, endeavored to increase the first property, which occasioned the far greatest consumption by the means of ice; and one of them, Procope Couteaux, an Italian from Florence, about the year 1660 conceived the happy idea of converting such beverage entirely into ice, by a process which had been before employed only by jugglers. The ready sale which he found for his invention induced others to make articles of like kind.

His example, therefore, was followed by Le Fervre and Foi; and these three, for some years, enjoyed the monopoly of the new-fashioned commodity. About the year 1676, liquors cooled by or changed into ice must, however, have been the principal thing sold by the limonadiers; for being then formed into a company, the following delicacies were mentioned in the patent which they received on the occasion: *Eaux de galee et glaces de fruits et de fleurs, d'anis et de canelle, franchipanne, d'aigre de cetre, du sorbec,* etc. There were at that time in Paris 250 masters in this employment. In 1690, when De la Quintiny wrote, iced liquors were extremely common.

People, however, long imagined that such articles could be used only during the hot months of summer. In the year 1750 Dubuisson, successor to the celebrated Procope, *au Cafe de la Rue des Fosses de S. Germain des Pres,* and author of the "Art du Distillateur," began to keep ready prepared, the whole year through, ices of every kind for the use of those who were fond of them. At first they were little called for, except in the dog days; but some physicians recommended them in certain disorders. Have the physicians then, by their opinion, done most service to the venders of liqueurs and to cooks, or the latter to the physicians? This would make a fine subject for an inaugural dissertation. It is, however, certain, for we are told so by Dubuisson himself, that after two cures, in which ice had been of the greatest service, the more discerning part of the public made use of them in every season of the year. That this part of the public might never lose their conceit, the venders of liqueurs always employed their thoughts upon new inventions. Among the latest is that of iced butter, which acquired its name on account of some likeness to that substance. It was first known at the Parisian coffee house (*caveau*) in 1774. The duke de Chartres often went thither to enjoy a glass of iced liquor, and the landlord, to his great satisfaction and surprise, having one day presented him with his arms formed of eatable ice, articles of a similar kind immediately became the mode. At present Dubuisson will, undoubtedly, say that the Parisians have lost all their discernment, for where are the dukes de Chartres?

——The building formerly owned by the Three Stars Ice Co., La Crosse, Wis., were burned July 24. The damage to the buildings in which the ice was contained, was $1,000 to $1,500, with no insurance; owned by David Austin. The ice belonged to Smith & Robinson, of the La Crosse Ice Co., and was valued at $1,500; total loss.

ICE FOR PNEUMONIA.

THE resolving power of ice the exudation is a marked feature in its therapeutic action, and must be regarded as one of the strongest factors in its curative influence, says Dr. Thomas J. Mays. The most apparent lesion in croupous pneumonia is an enormous distension of the pulmonary capillaries, partial or complete stasis of the blood in these vessels, and exudation of the fluid constituents of the blood, and diapedesis of white and red blood cells into the alveoli of the lung. It is well known that cold has the power of contracting the blood vessels, and from this action one can understand why it should exert a beneficial action on pneumonia by giving tone to the capillaries, by restoring the normal blood flow and thus checking the leakage. But there is often reason for believing that it also dissolves the exudation in the pulmonary alveoli. For example, there may be a pneumonic area in which there is absence of respiratory murmur, the presence of a flat percussion note and bronchial breathing indicating beyond a doubt that the process has passed beyond the stage of engorgement and into that in which the exudation has filled the alveoli, yet the application of ice will in a remarkably short time develop a new group of physical signs, such as crepitation, reappearance of the respiratory murmur, diminution of flatness, etc., indicating that a breakdown has occurred in the exudation.

Not less decided is the influence of the ice on some of the most prominent symptoms. The pain, difficult respiration, cough and expectoration are remarkably relieved, and the temperature is frequently depressed two and three degrees in the course of half a day. The benefit which is exerted on these symptoms produces a very agreeable effect, and often makes the ice acceptable to those who at first protest against its use. My own experience with the ice treatment does not show that it is accompanied or followed by any evil consequences.

It may be said, without claiming too much, that the results which have been obtained from the ice treatment of pneumonia are good. Out of fifty cases which I collected but two were fatal, making the death rate of 4 per cent. In estimating this mortality rate it must be remembered that at least one of the cases that died was an exceedingly unpromising one, being a sufferer from chronic lead poisoning and also very intemperate; while the pneumonia which caused death of the other one was in all probability an acute exacerbation of an old attack.

NEW CORPORATIONS.

THE following new companies have been licensed to incorporate during the past month. Where further information concerning them is known by ICE AND REFRIGERATION, notice is made in the regular departments:

ICE COMPANIES.

——Crystal Ice Co., Manitowoc, Wis.; $4,000.
——Middlesex Ice Co., Portland, Me.; $100,000.
——Lorimor Creamery Co., Lorimor, Iowa; $4,000.
——T. H. Davis Ice Mfg. Co., Pomeroy, Ohio; $40,000.

CREAMERIES.

——Antioch Creamery Co., Antioch, Ohio; $5,000.
——Vancouver Creamery Co., Vancouver, Wash.; $25,000.
——Lost Lake Butter and Cheese Association, Beaver Dam, Wis.; $5,000.

MISCELLANEOUS.

——Camden Ammonia Co., Camden, N. J.; $10,000.
——Anaconda Meat Co., Anaconda, Mont.; $10,000.
——Columbia Brewing Co., Shenandoah, Pa.; $100,000.
——Rockland Cold Storage Co., Rockland, Me.; $20,000.

[*Abstracted for* ICE AND REFRIGERATION.]

LEGAL MATTERS.

CONSTRUCTION OF CONTRACT FOR FURNISHING ICE AND FORMING POOL—THE QUESTION OF LIABILITY—MINOR LEGAL NOTES.

WHERE an ice dealer agrees with another to furnish him ice at certain prices until a pool is formed to advance prices, in which the latter is also to be a member, and the pool is formed, the contract is ended. In the formation of the pool, if acts are done, and resolutions offered, with which the party to whom the ice was to be sold does not agree, and refuses to become a member, he cannot hold the other party to the contract, and make him responsible for the acts of the members of the pool.

This the supreme court of Louisiana decided in the case of the *Consumers' Ice Co.* v. *Trautman* (reported in 12 *Southern Reporter*, 930) under the following circumstances: The Consumers' Ice Co. sued Jacob Trautman & Co. for $906.50, amount of ice sold and delivered to them between certain dates. The latter admitted this indebtedness, but alleged that the Consumers' Ice Co. was indebted to them in the sum of $5,288.75. This demand was based on an alleged contract by which that company was to furnish them with ice—some 1,500 tons—at a certain price, failing to do which, they had to get ice elsewhere for their business, the extra cost of which, including waste in shipping and freight bills, amounted to the above sum. The alleged contract was the result of several interviews between the president of the Consumers' Ice Co. and them, which terminated in the agreement, as alleged, that the Consumers' Ice Co. was to furnish ice to them at $5 per ton, in stated amounts, at certain dates, until a pool was formed, in which they were to be included. Ice was furnished them at $5 per ton to a certain time, after which the company declined to furnish it, except at market rates to large consumers.

The contention of Trautman & Co. was that no circumstances have ever occurred to put an end to the contract, and that the Consumers' Ice Co. was bound, under the same, to deliver ice at the rate of $5 per ton. It was in contemplation that all the ice dealers would go into the pool. Trautman & Co. were as active as the rest in procuring its formation. It was formed, and it seems a resolution was offered at the meeting to perfect the organization, that the dealers in natural ice should furnish their percentage in natural ice, whereupon Trautman & Co. refused to enter the pool. This action of the meeting was the ground for the argument that the contract to furnish ice at $5 per ton until the pool was formed still continued, as the president of the Consumers' Ice Co., who made the contract, was present, and made no protest or effort to oppose the proposition.

It might be very true, said the court, as urged by Trautman & Co., that they had no interest, after the adoption of the resolution, to enter the pool. It would have been, undoubtedly, to their advantage to stay out; sell any quantity of ice above the percentage at rates below the combination price. The Consumers' Ice Co. would have been furnishing the means to defeat the object for which the pool was formed. But it must have been known to Trautman & Co. that the object of the combination was to advance prices, and that its formation, with their consent, would annul their contract. The president of the Consumers' Ice Co. was not alone to fix the conditions of the membership. It was a future transaction of a body to be organized, in which Trautman & Co. were to be participants. They had as much voice as the president of the company in its organization. Its future deliberations were unknown, and its deliberations and conclusions could not be the acts of the Consumers' Ice Co. alone. It could not individually be held liable for the result of the organization and the conditions of membership. Each company engaged in the manufacture of ice went into it with the expectations of procuring an advantage which was not accorded to it. The testimony shows that each was dissatisfied with the percentage allowed, yet the pool was formed, and the contract, as understood by Trautman & Co., was ended. To say that their refusal to go into the pool continued the contract alleged to have been made with them would make the condition null and void.

MINOR LEGAL NOTES.

——The Philadelphia Packing and Provision Co., capitalized at $250,000, has gone into the hands of a receiver.

——J. R. Nelson has sued the Charleston (Ill.) Ice Manufacturing and Cold Storage Co. to collect $6,000 on two notes for $2,460 each.

——Cognovit judgments for $3,263.97 and $2,024.44 respectively, were entered August 3 against the Delaware Brewing and Ice Co. in favor of the First National bank, of Delaware, Ohio.

——The Iowa City (Iowa) packing house, August 16, was placed in the hands of a receiver. The company is capitalized at $120,000; liabilities, nominal; cause of difficulty, inability to get cash.

——On July 25 W. E. Eckles and E. T. Hogan, doing business under the name of Columbus Ice and Coal Co., St. Louis, assigned to Eugene F. Lingenfelder. The assets are $1,500, and embrace horses, wagons, harness, etc.

——The United Ice Co., Asbury Park, N. J., has certioraried to the supreme court for review the findings of the local court in the case of the borough against the ice company for failure to pay the license fee imposed by ordinance. The company claims that the license fee required for ice wagons is excessive, and not in conformity with the licenses imposed on other branches of trade.

——An action of interest to the ice trade will be tried at Hudson, N. Y., probably in October next, the facts on which the action is based being substantially as follows: "In February, last Winfield Stickles, a boy thirteen years old, was skating with other boys on the river at Stuyvesant, and against the warning of his companions ventured upon newly formed ice where the New Jersey Ice Co. had a few days previously harvested for storing. The ice broke and he was drowned. His father has been appointed administrator of his estate, and as such brings the action against the company to recover $5,000, alleging that his son's death was caused by the negligence of the company in omitting to maintain guards around its ice fields; while the latter claims in defense that suitable notice to the public of the location of the ice fields was given by bushes stationed in the river, according to the custom that has prevailed for years with those engaged in harvesting ice from the river, and that the negligence and carelessness of young Stickles himself contributed to his death."

A MATTER OF ENUNCIATION.

"What is that?" said a traveler to a fellow-passenger on a railroad train as they glided along the banks of the Hudson.

"Ice saw," laconically responded the other, as he glanced out on the river toward the ungainly object indicated.

"I supposed you did see, or I should not have asked you the question. You saw, and I saw too; but I did not know what it was."

"I said it was an ice saw."

"Very true, it is rather an eye sore, disfiguring as it does that pretty sheet of ice which makes such an excellent sheet for the ice boats to sail on; but still I am in the dark as to what it is."

"I didn't say eye sore; I said an ice saw."

"Oh a nice saw. Well, perhaps it is. Just depends on the way one looks at it. Thank you. Looks as though we were going to have a thaw.—*Exchange.*

ICE & REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION, THE TEXAS ICE MANUFACTURERS ASSOCIATION AND THE FLORIDA ICE MANUFACTURERS ASSOCIATION.

.·. SEPTEMBER, 1893 .·.

RATES OF SUBSCRIPTION.

IN ADVANCE, POSTAGE PREPAID.

United States, Canada and Mexico, - - - - $2.00 a Year
All other Countries, - - - - - - - - 3.00 "

Single copies 25 cents. Advertising rates on application to the offices. Remittances must be made by post-office orders, postal notes, international money orders, checks or drafts on New York, Chicago or London, payable to H. S. RICH & Co.

H. S. RICH   S. P. FOWLER   J. F. NICKERSON   JNO. GLENN COLLINS

H. S. RICH & CO.

PUBLISHERS,

177 La Salle St., Cor. Monroe, CHICAGO.   206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

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RESOLUTIONS.

AFTER the reading of Prof. Linde's paper on "The Refrigerating Machine of To-day" (printed elsewhere in part) before the recent meeting of the American Society of Mechanical Engineers, in Chicago, in August, by Mr. A. Sorge, a short discussion followed between Mr. Sorge and Prof. Jacobus, of Hoboken, N. J., the latter answering the note in reference to the test of Pictet and Linde machines in Munich some time since (which note forms a part of the paper which will appear in the October issue of this journal). The discussion closed, Mr. Sorge offered the following resolution, which was adopted:

To recommend to the council: To appoint a committee to decide upon standard rules for testing refrigerating machines, and who will, in doing this, correspond and act in conjunction with the Polytechnical Society in Munich, and with the Munich committee for testing refrigerating machines.

IT IS suggested that a good way to keep a piece of ice over night in a glass is to cut a piece of white flannel about ten inches square. Place this over the top of a tumbler, pressing the flannel down half way or more into it. Then bind the flannel fast to the top of the glass with a string. Put the ice into the flannel cup and lay another piece of flannel five or six inches square upon the ice. Arranged thus, ice will keep many hours.

THE London *Lancet* reports the invention in Germany of an instrument for the utilization of cold as a means of producing caustic effects similar to those of intense heat. The advantages of this method of cauterizing in certain classes of cases will be at once apparent. It cannot, however, completely replace the Paquelin thermo-cautery, or electric cautery, since the latter not only devitalizes but destroys the tissues, and at the same time renders them absolutely sterile, a fact of no small value in certain surgical cases.

DR. H. C. WOOD calls attention to the value of a large enema of cold water in the treatment of dysentery. We have made use of this valuable remedy for the last fifteen or sixteen years, and with excellent success in many cases. In some instances we find the use of hot water preferable. Our practice is to employ hot water first, as the best means of cleansing the diseased surface. If this does not give prompt relief, cold water, or even ice water, is employed in as large a quantity as the patient can readily retain. This remedy is especially valuable when the disease is located in the lower part of the colon. Dr. Wood sometimes employs ice suppositories, which he introduces in rapid succession, usually one every three to five minutes until eight or ten have been introduced.

ANSWERS TO CORRESPONDENTS.

TEST FOR TRACES OF AMMONIA—MATERIAL FOR PACKING ICE—PER CENT OF AMMONIA IN POOR LIQUID—AMMONIA PRESSURE GAUGES—THE BEAUME SCALE FOR AMMONIA—FREEZING TIME FOR ICE.

[This department of ICE AND REFRIGERATION is conducted for the benefit of the trade generally, as well as individuals; and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

TEST FOR TRACES OF AMMONIA.

To the Editor: Can you give us any test for detecting ammonia in either distilled water or brine? for instance, a leak either in the brine or distilled water tanks, but which is so slight you are unable to detect by smell. If there is any test we would thank you very much for the information, as we are having trouble with an ammonia leak which, as yet, we have been unable to locate. P. I. F.

ANSWER.—There are a number of tests which will show the presence of small quantities of ammonia in water. Among others the addition of a few drops of a solution of neutral sub-nitrate of mercury to a small portion of such water contained in a test tube will show the presence of traces of ammonia by a brown coloration. In the same way a solution of corrosive sublimate will show a white precipitate. But by far the most sensitive reagent or test for this purpose is the so-called "Nessler Reagent" which is prepared as follows:

Dissolve 17 grams of mercuric chloride in about 300 c.c. of distilled water; dissolve 35 grams of potassium iodide in 100 c.c. of water; add the former solution to the latter, with constant stirring, until a slight permanent red precipitate is produced. Next dissolve 120 grams of potassium hydrate in about 200 c.c. of water; allow the solution to cool; add it to the above solution, and make up with water to one liter, then add mercuric chloride solution until a permanent precipitate again forms; allow to stand till settled, and decant off the clear solution for use; keep it in glass stoppered blue bottles, and set away in a dark place to keep it from decomposing.

The application of this reagent for your purpose is very simple, a few drops of the same being added to the water or brine in question, contained in a test tube or a small glass of any other kind. If the smallest trace of ammonia is present a yellow coloring of the liquid will take place, which turns to a full brown when the quantity of ammonia present is larger. The degree of this coloration is so characteristic that it may be used for the purpose of making an approximate test of the quantity of ammonia present; but this would require more extensive manipulations.

MATERIAL FOR PACKING ICE.

To the Editor: Up to date we have been shipping ice by express in oat bags well packed in sawdust. Recently this sawdust has become quite an expensive article. Now, do you know of any other way to ship ice in 100-pound lots to preserve it? If you do not, please look into the matter and inform us as soon as possible. Possibly some kind of paper or paper bag may be utilized. ED. W.

ANSWER.—One reply was suggested to this query in our last issue. In addition, we have a note from a friend in Florida, who says: "A very good substitute for sawdust is planer shavings. If these cannot be had, I can think of no better substitute than mineral wool. This should be charged for and allowance made for its return, dried and in good condition. In using this material, the block should be packed with open burlaps instead of a sack. This would give good results with small amount of material, and the package can be put up even more quickly than with sack and sawdust. I am confident, however, that if these Louisiana people have a railroad or water connection they can get sawdust cheaper. It could be brought from Pensacola by schooner or from long distances by rail at small cost. I am getting my sawdust from a considerable distance by rail at a cost of not more than four cents per sack of ice (200 pounds). Others, who have observed the query, suggest the use of rice chaff; but in the main the belief is that sawdust can be brought from a long distance, if necessary, at a price that will warrant its use.

To the Editor: Can you inform us what is the average percentage of ammonia contained in the poor liquor used in absorption ice machines, or how it can be determined by a simple test? By poor liquor we mean the liquor by which the gas from the tank coils is to be absorbed.

A reply to the above will greatly oblige H. S.

ANSWER.—This depends largely on the working of the machine. The more perfect the generator or still, the less ammonia will be carried over to the absorber with the poor liquor. Other circumstances also influence this point. We think that 2 per cent is about as low percentage of ammonia as may generally be found in poor liquor. To determine the exact quantity would require a chemical examination in each case, as such low percentages cannot be satisfactorily determined by means of a hydrometer or specific gravity scale or stem.

AMMONIA PRESSURE GAUGES.

To the Editor: The usual ammonia pressure gauges are somewhat costly. Could not mercury gauges consisting of a bent glass tube containing mercury, such as have been used for steam boilers heretofore, be used as ammonia pressure gauges? It seems to me that they would be much cheaper and at least as correct as the dial gauges now in use. What is the opinion of ICE AND REFRIGERATION on this subject? F. K.

ANSWER.—We presume that such gauges could be used for the purpose mentioned, although they would be very inconvenient and fragile in our opinion, since the mercury column and consequently the glass tubing would have to be very long in order to show such high pressures as obtain with ammonia. It would also be advisable, we think, to cover the mercury in the branch connected with the ammonia receptacle with some neutral liquid not acted on by ammonia, as the latter substance is not without influence on the mercury. If the other end of the glass tube containing the mercury be sealed, with an air space above the mercury, the instrument may be shortened to any desired size, as in that case not the height of the mercury column, but the compression of the air above furnishes the pressure indication. The graduation of the instrument in this case, however, becomes more complicated, and hence the same is more liable to be faulty in its indications.

THE BEAUME SCALE FOR AMMONIA.

To the Editor: In speaking of aqua ammonia as used for absorption machines, the strength of this substance is frequently alluded to as being so many degrees Beaume. Can you tell us what these degrees purport, and how they compare with ordinary thermometer degrees? G. H. D.

ANSWER.—Degrees Beaumé indicate certain specific gravities, and for that reason are not comparable with degrees of any thermometer whatever, since the latter instruments indicate temperatures. As to the significance of degrees Beaumé in general, it should be noted that there are three Beaumé specific gravity scales, or

hydrometers: one for liquids which are heavier than water, and two for liquids lighter than water. Of the latter two the scale of one designates pure water 10, and the other designates pure water zero. As ammonia liquor (comprising mixtures of water and ammonia in all proportions) is lighter than water, only the latter two Beaumé scales come into question in this respect, and generally the one which designates pure water 10 is referred to when mentioned in connection with ammonia liquor, and the degrees given in this connection correspond to a certain specific gravity, *i. e.*, to a certain percentage of water and ammonia as contained in the ammonia liquor.

The following table is compiled to show the relations of the strength of ammonia liquor to the specific gravity and the indication of the hydrometer scales as mentioned by you.

Percentage of Ammonia by Weight.	Specific Gravity.	Degrees Water 10.	Beaume Water 0.
10	--0.960	—16	—6
12	--0.953	—17.1	—7
14	—0.945	—18.3	—8.2
16	—0.938	—19.5	—9.2
18	—0.931	—20.7	10.3
20	—0.925	—21.7	11.2
22	—0.919	—22.8	12.3
24	—0.913	--23 9	13.2
26	—0.907	—24.8	14.3
28	—0.902	—25.7	15.2
30	—0.897	—26.6	16.2
32	—0.892	—27.5	17.3
34	—0.888	—28.4	18.2
36	—0.884	—29.3	19.1

Such a Beaumé specific gravity or hydrometer scale can be procured at any optician's. It is inserted in the ammonia liquor to be tested (the latter being contained in a convenient glass jar) and the degrees read off at the temperature designated on the hydrometer (generally 60° F.).

FREEZING TIME FOR ICE.

To the Editor: How many hours are required to freeze ice in molds of the following natural dimensions: 8×8 inches: 8×16 inches; 10×20 inches; 11×14 inches; 11×22 inches; depth of molds being 32 and 44 inches respectively?

How many feet of 1¼-inch expansion pipe are required for an ice tank per 1 ton of ice in twenty-four hours? O. J.

ANSWER.—The time required for freezing ice depends on the temperature of the bath and the temperature of the water. It is held by some experts that the composition of the water has a material influence upon the time of freezing, but this appears to us a doubtful proposition. The air contained in some waters may have some influence, but this also cuts no figure when the water has been previously boiled or distilled. If the bath is held at 15° F., ice 11 inches thick will take about fifty hours to close, 10 inches will take about forty-two hours, and 8 inches about twenty-six hours. If the temperature is 10° F., it will take 25 per cent less time, but the ice will be brittle, otherwise all right. As to the amount of piping required for a ton of ice daily, that is a point that varies according to the lung power to do the work, and varies from 200 feet to 350 feet; but we think that 300 feet is ample. If the smallest quantity is used the cylinder or lung capacity must be increased to compensate for shortage in surface.

——The buildings of the Cleveland Knickerbocker Ice Co. were burned August 2. The loss included the main building, which was 207×122 feet in size, also the adjacent miscellaneous buildings, stables, a number of horses and wagons, etc. The loss is fixed at $50,000; insurance, $18,000. Rebuilding will begin at once.

THE extreme stringency of the money market has, of course, had its effect on the ice machine builders, who find business extremely dull, as are all other lines of manufacturing, and who expect, like the rest of the world, to wait until the furore has run its course before expecting to do much business in the future. In spite of the times, however, there seems to be a "show" of business in the line, as indicated by our notes below:

ARIZONA.

Clifton.—Messrs. J. Abraham, Sam Abraham, Wm. McGinnis and Chas. Wright are putting up an ice machine on the west side of the Frisco river. The machine was all on the ground in July.

Mesa.—A company, with capital of $10,000, has been organized here to build an ice factory and cold storage house. The ice factory will have ten tons capacity. The following are the incorporators: C. Fuller, C. W. Crouse, Orrin Merrill, Orlando Merrill and M. A. Cruse.

ARKANSAS.

Pine Bluff.—Captain Hick has ordered a new 25-ton ice machine to be erected in his factory this fall.

CALIFORNIA.

Agnews.—A Vulcan refrigerating and ice plant has just been installed in the state asylum for insane. This plant has recently been started in operation and is giving great satisfaction to the directors of the asylum.

Santa Rosa.—Henry S. Bayer, Geo. E. Toale and Henry Buist, of Charleston, S. C., have been looking at the city with a view to building an ice factory. They ask the citizens to take $10,000 of stock in the Sonoma Ice Manufacturing Co. They take the balance of $22,000.

COLORADO.

Greens Farms.—Wm. Sooysmith is building an ice factory here.

Trinidad.—The new 15-ton ice machine of the Ph. Schneider Brewing Co. has been started up. It was built by the American Ice Machine Co., of St. Louis.

ILLINOIS.

Peoria.—An ice factory is to be rented here, the machinery to be furnished by F. X. Kuhn, of Philadelphia.

LOUISIANA.

New Orleans.—The New Consumers' Ice Co. has been incorporated by N. D. Wallace, J. G. Jenkins, H. H. Hall, A. Brittin, John R. Feil, H. C. Menor and C. J. Michaeloffsky; capital, $400,000.

PENNSYLVANIA.

Scranton.—The Consumers' Ice Co. is doubling its capacity.

Pottstown.—The new ice plant of the Pottstown Cold Storage Co. has been put in operation. The additional buildings and machinery cost about $40,000.

Weissport.—The artificial ice machine is turning out from ten to twelve tons of ice per day. It has been much enlarged lately, and the capacity will soon be doubled.

TENNESSEE.

Humboldt.—Beare Bros. are in the market for a 10-ton ice machine for next season.

TEXAS.

Llano.—The Llano Ice Co. will rebuild its factory, reported in this issue as burned.

Madisonville.—The machinery for the ice factory has arrived. In the well, eight feet square, being sunk for the purpose of supplying the factory, the workers found water at a depth of sixteen feet.

Temple.—The Temple Cold Storage and Ice Co. has been incorporated with capital stock of $30,000; directors: George Toland, William Carton, George Bond, P. L. Downs, O. N. Haschke, William McGarry and C. A. Brand.

VIRGINIA.

Front Royal.—The Front Royal and Riverton Improvement Co. is thinking of erecting an ice factory next spring.

Portsmouth.—Mr. C. R. Robinson has received the plans for his proposed 5-ton ice factory and cold storage plant. The site will be on South street.

THE ICE TRADE

THE TRADE.

HOWEVER unsatisfactory the wholesale trade of Maine may be—and there is little room for doubt that it is very unsatisfactory—the retail trade of the country, as a whole, has been very good and reasonably remunerative. Considering the great stores of ice cut last winter it is somewhat surprising to hear from interior towns that stocks have been exhausted even prior to August 1, but such is the case as a matter of fact.

In the South the general testimony is that factories are running to full capacity. This is to be expected, probably, at this season, but it must be remembered that this is not an invariable condition in midsummer, for though the heat in that section is great, nevertheless habit has made it possible for the bulk of the people to get along without using it, except on special occasions, or in a notably hot "spell." The use of ice, paradoxical as it may sound, is peculiarly a cultivated taste, or an artificial want, with many people.

A Gainesville (Fla.) paper makes a remark on the local ice trade, which turns a good deal of light on the business in the South, which may be new to those who think that ice making is like picking up gold eagles in the highway, or that prices are always exorbitant. The paper says: "A. J. McArthur, manager of the ice factory, says that Gainesville uses about two and a half to three tons of ice a day during hot weather, and only about 1,200 pounds the rest of the year. He makes about two tons a day more ice than he can dispose of, except during about six weeks of vegetable shipping. There are now five factories occupying the territory that was supplied from this point six years ago. In the last three years there have been only five days that ice was not delivered on the streets of Gainesville."

THE ice companies at Rockford have experimented with the cash system this season, and find it so satisfactory that on August 1 the system was formally adopted by the City Ice Co., which has put on the market three kinds of coupon tickets. The first is for small consumers, who use from twenty-five to fifty pounds a day. These call for 275 pounds for $1. The second coupon is for consumers who purchase from fifty to 150 pounds a day. They are good for 625 pounds for $2. No extra charge for washing the ice and putting it in boxes is made on the $1 and $2 coupon tickets. These figures are a reduction of 10 per cent from former rates. There is a third form comprising 15-pound daily coupon tickets, thirty coupons for $1.75, if ice is not washed and placed in a refrigerator, or $2.25 if it is so cared for. This old rate is continued on account of small deliveries.

A Sioux city speculator having gotten possession of about 8,000 tons of Floyd river ice put up by the Silberhorn company, but which it will be unable to use, has been making contracts to supply customers for the balance of the season at the uniform price of ten cents per 100 pounds. The cut on the price of regular dealers is nearly 50 per cent, they having been getting from thirteen to twenty-five cents per 100 for cooling ice. They are still selling at the old prices, however, and say that they will make no cuts to meet the competition.

A local paper at Milledgeville, Ga., August 5, says: "An ice war is raging here, and a nickel buys more ice than the average citizen wants at one time. The battle opened yesterday between two of the strongest concerns here, and during the day the price dropped from fifty to twenty-five cents per 100 pounds. The cut has been going on all day to-day, and a reduction of from one to two cents a hundred followed each other as rapidly as the announcement could be made through flaming circulars. Both dealers vow that they will either sink or swim, while the complacent and perspiring citizen smiles because he can keep cool on cheap ice, while the hot sun makes the cotton grow. It is thought the price will reach ten cents a hundred by to-morrow and ice cold watermelons will furnish the menu in many homes on Sunday at dinner."

On July 27, Mayor Manning, of Albany, N. Y., awarded the contract for furnishing ice to the city hall from August 1, 1893, to August 1, 1894. There were four bidders: Schifferdecker Bros., fifteen cents per 100; George William Warren, seven and a half cents; R. B. Rock & Son, ten, and Hudson Valley Ice Co., seven and a half. About 400 pounds a day delivered. The bid of the Hudson Valley Co. was informal and the contract was awarded to George W. Warren.

A BOSTON paper speaking of the ice trade of New England with the South, and the discouraging condition of that trade this season, says: "Ice men in the eastern states depend largely upon the South for a market for their goods. Were the amount of ice harvested each winter limited to the demands for home use during the summer at least one-half of the men who are now getting their living from the results of the work of Jack Frost would be forced to do something else. A cold winter is hailed with delight by the ice men, for then they are sure of getting enough to supply all demands in the warm months. But there is such a thing, however, as having too much cold weather, and ruining the market in that way. The home demand remains about the same year after year, and may be depended

upon, but this year the southern market is a flat failure, for the reason that the crop was harvested from the rivers of the South last winter. A man who has been in the ice business in Boston for a great many years said to-day that there had never been a year in his remembrance when so little ice was being shipped south as this year. In speaking of the matter he said: 'Last winter was so cold all over this country that away down in Delaware they cut plenty of ice to supply themselves and ship great quantities still farther south. Of course, the people will buy at the market nearest home, and thus save the additional freight rates. I estimate that about half the usual quantity of ice is being shipped to the southern states this summer, and the result will be that those men who depend almost entirely upon the southern market will fail to get a considerable amount of the money expected.'"

THIS view is amply confirmed by notes of the condition of things in Maine. One report, dated August 11 from Augusta, says: "The Kennebec ice business is dull. Out of thirty-two blocks of houses filled shipments have been made from only fourteen thus far. It appears almost certain that the largest stock of ice in the history of the Kennebec trade will be carried over. The only activity along the river is at the Great Falls Ice Co.'s houses at South Gardiner, where they are erecting a new block. Last season this company loaded fully 5,000 tons from Maine for Atlantic City, N. J. This season the entire shipment to that point is only 350 tons."

A still earlier report (July 28) from Bangor, says: "The Rockport Ice Co. has shipped since January 1, 21,500 tons of ice—twenty-seven cargoes in all. Most of the ice has been sent to Baltimore and Philadelphia. Four cargoes were shipped to Port au Prince, Hayti. The price of ice is very low—far below the average. The company will commence again in a week."

It is generally conceded that the Maine trade this year is the most unsatisfactory since 1879, one correspondent estimating shipments from the Kennebec to August 1 at less than 300,000 tons, out of 700,000 in store.

It is now expected that one-half of the ice cut last winter will be carried over unless the autumn should prove unusually warm and long.

NATURAL ICE NOTES.

——Sandusky parties will open a branch house for the sale of ice in Findlay, Ohio.

——The Middlesex Ice Co., July 27, began shipping ice from Georgetown, Mass., to Boston.

——The Lake Mahopac ice houses are being emptied of ice for New York city consumption.

——A. Q. Coolidge reports the ice trade at Rumford Falls, Me., as now lively and satisfactory.

——The Knickerbocker Ice Co. have closed their ice houses at Verplanck's Point, on the Hudson.

——The Brewers' Ice Co., New York, has thoroughly overhauled the ice houses at St. Remy, N. Y.

——The local ice supply of Ashland, Kan., gave out August 14. Future supplies will be gotten at Wichita.

——Henry Witter, Bucyrus, Ohio, has exhausted the supply of ice put up by him, and is now buying lake ice for his trade.

——John F. Winkler will build an ice house at Saginaw, Mich., to hold 20,000 tons. It will be 130×200 feet, 32-foot posts.

——Sioux City is having a large and steady demand for ice from neighboring Iowa towns which has stimulated the trade there considerably.

——The Bay County Ice Co., Bay City, Mich., will build new houses at Tobico this fall, in order to have next year double this season's sale of ice.

——Samuel Ceasar, ice dealer, of Dalton, has purchased land near Pittsfield, Mass., where he will construct an ice pond by enlarging the dykes. He will also erect new storage houses and a residence.

——The People's Ice Co., Floriston, Cal., have shipped out of their houses some 600 cars. The Tahoe has emptied one house of some 8,000 tons, and still has one filled. The Floriston (old) is open now, and they are shipping it out. It contained some 8,000 tons, while their new house has about the same amount. The National Ice Co. has about 8,000 tons in their house, and the Rocky Run will ship out about 5,000 tons. With the ice at Verdi and some at Boca, this is about all there will be for shipment.

——The New Haven (Conn.) Ice Co. will build a number of modern ice houses this fall at Lake Whitney, where the company has lately acquired new holdings of real estate. In order to carve out a building site along the bluff that stretches down to the waters of the lake, and to make a road in the rear of the houses it has been necessary to remove thousands of loads of dirt. The new houses will have a capacity of about 10,000 tons, and be divided into compartments 30×90 feet, with a capacity of some 1,800 tons each.

ICY ITEMS.

——Harper & Hill is the new ice firm at Wenham and Danvers, Mass.

——The City Ice Co., of Knoxville, Tenn., will move its plant to Murfreesboro.

——E. H. Perkins, Bristol, Conn., has sold his ice business to John P. Leach.

——Geo. Doehne, brewer, at Harrisburg, Pa., will erect a cold storage house.

——A Michigan refrigerator factory recently shipped a car load of goods to Australia.

——The Knickerbocker Ice Co. had a small strike among its men at Poughkeepsie, N. Y.

——Nichols & Giese, ice dealers, at Kankakee, have dissolved partnership, Mr. Giese retiring.

——The Cedar Lake Ice Co., Hammond, Ind., has sold out its business to the Wolf Lake Ice Co.

——Rev. E. Erb has sold out his ice business to J. D. Countz, of Lincoln, Neb., who will extend his trade to East Lincoln.

——J. O. Curtis, of the Hygeia Ice Co., Hartford, Conn., is sinking a new well on his premises to get further water supplies.

——The Ice and Cold Machine Co., St. Louis, has finished setting up a 110-ton machine in the Home brewery, St. Louis.

——The Boston Ice Co. and the Drivers' Union Ice Co. have agreed among themselves not to poach on each other's customers in Chelsea.

——The ice plant of the Chattanooga Ice and Bottling Co. has not been started up this season, but the bottling department has been very busy.

——The Crystal Ice Co., of Wauwatosa, Wis., with capital of $4,000, has been incorporated by Henry Watner, J. H. Johnson, E. L. Watner and L. Johnson.

——The Cold Storage Co., at Mason City, Iowa, shut down July 25. Dull times and the unsettled condition of the money market is assigned as the cause. It will resume in about thirty days.

——The Lackawanna Refrigerator Transit Co., of Kansas City, has advertised for bids for the construction of 1,000 beef refrigerator cars, some of which will be required for September delivery.

——In a fire started by children at Frederick, Md., A. C. McCardell lost an ice house, stable and 100 tons of ice, all worth $1,000; and Sam'l Kline, similar property and 200 to 300 tons of ice, all worth $800.

——The ice houses of the Schmitt brewery, Indianapolis, were burned August 7. The house was 100×200 feet, and contained $10,000 worth of ice. The plant was almost a total ruin. The loss was $15,000; insurance, $10,000.

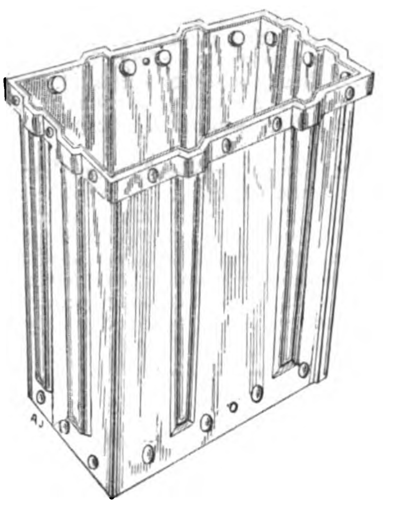
——On August 13 two ice houses of J. P. Smith & Co., east of Indiana avenue and south of Fifteenth street, Chicago, took fire, and these ancient landmarks were almost totally destroyed. None of the burned buildings contained any ice. The total loss will probably not exceed $2,000; fully insured.

——A. Sorge, Esq., lately with the F. W. Wolf Co., Chicago, on August 15 sailed for Germany to take a position as manager of the Berlin branch of the Linde Ice Machine Co., of Germany. Mr. Sorge made many friends during his residence in America who will regret his departure from this country, though congratulating him on his advancement in his profession.

——C. F. Meyers, William Mappus, G. W. Meyer, A. S. Grant and F. L. Hackermann have incorporated the Cold Storage Manufacturing and Transportation Co., at Charleston, S. C., with $5,000 capital. The company's purpose is to manufacture and buy patents of food transporting vehicles. It is reported that 60 per cent of the stock is subscribed, and 20 per cent has been called, payable September 1.

ICE FOR STORAGE.

ONE difficulty experienced by many ice manufacturers who have undertaken to store manufactured ice has been the freezing together of the blocks while in storage; when packed away, one upon the other, without any sort of separation. When ice is so frozen, of course, it is practically impossible to take out the blocks in anything like merchantable condition. The usual practice is to pack the ice with thin strips of wood between each layer of blocks, thus separating the blocks and preventing freezing; and this method has perhaps been more generally successful and satisfactory than any other.



However, Mr. James A. Smith, Sr., of St. Louis, Mo., now appears with a new form of ice can, or freezing mold, which gives a ribbed surface to the block on every side or end save the top. The cut above fully explains the idea by showing the form of the can, which, of course, is tapered from top to bottom like the ordinary can, and otherwise handled exactly the same. The claim is made that the ribs on ice will sufficiently separate the mass of the blocks from each other and prevent freezing together by contact, and that the ice can be readily removed from storage without loss or shrinkage.

SMALL MACHINES.*

THERE are many straws pointing as indicators to the fact that in the future the small refrigerating machine, with capacity of 500 pounds and upwards, in multiples of 500 pounds, will be a machine born of a substantial and widespread demand. The world at large is beginning to find out what this mysterious thing, a refrigerating machine, is; and there is every reason to believe that the demand for small machines from butchers in inland towns of 5,000 people and upwards, by creameries, by ice cream makers, large saloons, restaurants, etc., will grow rapidly when the perfect small machine makes its appearance and is sold at a reasonably low price.

The most novel machine of this type we have yet seen is a new compression machine invented by Thomas L. Rankin, now (or shortly to be) on exhibition in Machinery hall, near the pumping basin. The distinguishing feature of the machine is the compressor—a rotary compressor pump, the first successful application, we believe, of the rotary principle to ammonia gas compression. At a back pressure of 20 to 30 pounds it works like a charm. We are not aware that any careful measurements of the capacity of this little machine, theoretical or actual, have been made; but when first set up at Mr. Barber's butter house on South Water street, Chicago, it demonstrated, under most unfavorable conditions, a capacity fully that estimated: 500 pounds; yet one could almost carry off the compressor in his overcoat pocket, and the whole apparatus complete, with piping, etc., would not begin to fill a one-horse market wagon.

Those of our readers who attend the Fair hereafter prior to November 1, will find this little machine of enough interest, whatever the character of their own plants, to make it a visit.

NEW COLD STORAGE PLANTS.

THE following is the record of new work projected and completed during the past month.

KANSAS.

Wichita.—The Crystal Ice Co. is thinking of adding cold storage to their business this fall, to be ready for next spring's business.

MAINE.

Rockland.—The Rockland Cold Storage Co. was organized August 1 with capital stock of $20,000. The company is formed to control and operate the extensive cold storage plant in course of construction at Tillson's wharf. It is expected that there will be in consequence a considerable increase of business in the fishing industry having its center in that city as a result of the improved facilities for the preservation of fish thus afforded. The officers of the new corporation are as follows: President, Loring B. Haskell, Gloucester; treasurer, Charles E. Weeks, Rockland; directors, L. B. Haskell, Wm. H. Perkins, M. J. Palson, Gloucester; Davis Tillson, Stephen Chase, Rockland. The company of Gloucester men owning the cold storage patents under which the plant is operated have also formed a corporation here under the Maine laws, with capital stock of $100,000, of which W. H. Perkins is president and Loring B. Haskell, treasurer.

MASSACHUSETTS.

Provincetown.—Work on the cold storage plant is being pushed forward with all the vigor possible, and it is the hope of the management that it will be completed early the coming month. The building is nearly finished and the workmen are engaged in putting in the conducting pipes.

NEW YORK.

Buffalo.—The large 5-story building of the Buffalo Cold Storage Co. on Perry street is rapidly progressing toward completion. It will cost when completed, aside from the machinery, nearly $200,000. An expensive refrigerating plant will be installed in the building. It is expected that the building will be ready for occupancy by October 1.

ONTARIO.

Brockville.—The contract for the erection of John L. Upham's new cold storage house on Water street was let August 15.

OREGON.

Portland.—The Portland Artificial Ice Co. is building under the supervision of W. H. Harris and W. E. Harris, the company's mechanical superintendent, an improved fish freezer and cold storage. It is to be one of the most complete plants of its kind in this country, and is on an entirely new plan. The building is three stores high, and will be cooled by both direct expansion and brine circulation. It will be ready for business early in September.

TRADE NOTES.

——On August 25 the secretary of state of Illinois licensed the incorporation of the Hercules Ice Machine Co., of Aurora, by Edward Worcester, W. H. Cotterell, Jos. H. Defrees; capital, $500,000. This new company, it is understood, has been organized by the creditors of the Hercules Iron Works, and will succeed to that business. It is probable that the works at Aurora will be started up again very soon, and the business pushed, the office, however, being in Aurora.

——At a creditors' meeting of the Whitehill Engine and Pictet Ice Machine Co., in New York, July 29, they authorized Robert Whitehill, the assignee, to complete the unfinished contracts amounting to $21,170.14 and also to continue operating the foundry and machine shop. A statement shows the indebtedness of the company to be $85,793.94 and a mortgage of $36.000. The inventory of property shows $110,000 worth; $40,000 in book accounts; uncompleted contracts, $21,170.14; plant (cost price), $300,000; capital stock of the company, $500,000.

——On August 26 the Vilter Manufacturing Co., of Milwaukee, builders of ice machines, Corliss engines and brewers' machinery, made an assignment to Herman S. Segnitz. The assets are placed at $325,000 and liabilities at $140,000. The company, in a circular to its creditors, says its financial embarrassment is caused by the loss in the conflagration last October of $40,000 and the consequent need of putting $50,000 previously active capital into a new plant, the stringency of the times, the abridged banking facilities of the city, and the absolute impossibility of making collections of money due it. It is believed the company's difficulties will be adjusted as soon as the financial disorders of Milwaukee and the country permit, when business will be resumed.

THE sensation in packing circles for the month was the failure of John Cudahy and A. W. Wright, at Chicago, August 1, when the big pork and lard deals engineered by them collapsed for want of funds. They carried down with them several brokerage firms and also the North American Provision Co., and involved N. K. Fairbank quite heavily. Not since the day in 1887, when the Harper deal in wheat went to pieces, it is asserted, has any such widespread disaster come upon the speculative interest. The best estimates of the aggregate of the liabilities put it at between $3,000,000 and $4,000,000. The losses stated for Cudahy are $1,600,000; Fairbanks, $800,000; North American Provision Co., $110,000; A. W. Wright, $450,000; and so on. Fairbank settles in full, and Cudahy also in full nominally. It is said his brothers have come to his assistance by guaranteeing the payment to the trustees of the estates of John Cudahy and Charles L. Hutchinson of $100,000 each year for five years. This practically amounts to a contract to pay the creditors of John Cudahy $500,000 in five yearly installments, in addition to the amount already secured by Cudahy himself, that is, real estate and collateral amounting to $830,000, making therefore $1,330,000, or about 85 per cent of the whole. Most of the creditors were reported as showing a willingness to settle on the basis of the first proposition of 50 per cent secured and the remainder in personal notes. This proposition will probably be accepted.

PACKING HOUSE NOTES.

——The Armour Packing Co. will build a meat cooler at W. Superior, Wis.

——Cudahy's packing house, South Omaha, August 14, announced a 10 per cent reduction in wages to take effect at once.

——The Bloomington (Ill.) packing house began packing hogs August 14; capacity, 300 daily.

——The Cudahy Packing Co. now requires its customers in Manistee and Ludington, Mich., to settle weekly instead of monthly as heretofore.

——C. R. Robertson & Sons, Norfolk, have purchased a Warwick machine from E. C. Hillyer & Co., Newport News, Va., to be used in their meat market.

——The Ice and Cold Machine Co., St. Louis, has just finished setting up a 250-ton refrigerating machine with compound condensing engine for Swift & Co., at East St. Louis.

——Isaac Kleeman, Clarksville, Tenn., has bought a 10-ton Sulzer-Vogt refrigerating machine, to be set up at one of their meat depots, the firm now having one similar machine at work at Clarksville.

——Reed Bros. Packing Co., Limited, made the first direct importation of gold ever made by a Kansas City company, having, August 5, received notice that $100,000 had been shipped to them from Belfast, Ireland.

——On August 12 the fertilizer works of Nelson Morris & Co.'s plant, Chicago, were burned, causing a loss of $100,000; which is covered by insurance. The plant will be rebuilt at once. The meat departments were saved from destruction by a good fire wall.

——The first large importation of gold coin ever made from Europe, it is believed, by a purely commercial house arrived in New York from London, August 10, for P. D. Armour & Co., and was immediately shipped to Chicago for use by that house. The amount was $500,000.

——Mr. J. J. Delaney, manager of the Nashville Packing Co., Nashville, Tenn., is informed that the failure of Mr. John Cudahy would not affect the Nashville Packing Co.'s business. Mr. Cudahy is interested in this business, but the property is owned and will be operated by a company.

——It was reported in St. Louis, August 12, that the large packing house of Francis W. Whittaker & Sons, which succumbed recently to financial stress, will shortly resume business. Word was received that John Whittaker had succeeded in his mission to London and will return with English backing to float the business.

——Concerning the Rodeo Packing Co., of Rodeo, Contra Costa county, Cal., which was reported to have failed, J. J. Silberhorn said, August 3: "The business of the Rodeo Packing Co. has not failed, as reported, but has suspended operations for a few weeks. The Chicago firm of W. H. Silberhorn & Co. is in no way affected, as the two concerns are entirely separate."

——The employes of several of the departments in the Armour packing house at Kansas City received notice August 19 that thereafter wages would be 10 per cent less than heretofore. The announcement caused much dissatisfaction, and fifty plumbers, steam fitters and blacksmiths laid down their tools and walked out. There was no indication of a strike in the other departments.

——James Wolfe, of Asheville, N. C., has just finished the construction of a complete slaughter house 100 feet long, two stories high at the lower end, with an enclosure at the lower end for live stock, which is paved with brick. Within the slaughter house is every convenience known to slaughterers. Mr. Wolfe proposes shortly to begin the erection of a cold storage warehouse in connection with this house, which will have a capacity of 200 beeves and 300 sheep.

——A new chill room and beef house is to be built by Emil Kohn, of 242 Belmont avenue, Newark, N. J., with a complete system of tracking from the old abattoir into the new refrigerator. The new building is to be 30×50 feet; the first story or basement is to be used as a stock shed. The abattoir is to be on the main floor, and twenty feet off one end is to be the chill room, and the second story is to contain the ice chamber and store room. The dressed beef house is to be fitted up in the best manner, with all the latest labor saving appliances, such as patent switches cut into sliding partitions, etc.

FIRE AND ACCIDENT RECORD.

——W. W. Adams' ice houses at Butte, Mont., were burned August 14.

——Swift Bros.' ice houses at Roberts, Mass., were burned July 28; loss, $6,000.

——A barn of the Wisconsin Lakes Ice Co., at Milwaukee, burned July 1; loss, $500.

——The Lafayette (Ind.) Artificial Ice Co.'s plant was burned July 28; loss, $60,000.

——The ice house of the New York Central hotel, Niagara Falls, was burned August 19.

——The Rio Grande railroad ice house at Burnham, Colo., was burned July 29; loss, $1,000.

——The Consumers' Ice Co.'s plant, Covington, Ky., was damaged $1,000 by fire July 29; insured.

——The W. J. Lemp Brewing Co.'s beer depot and ice plant at Springfield, Mo., were burned August 9.

——In the big fire of August 13, at Minneapolis, the Cedar Lake Ice Co. lost $5,000 worth of property.

——L. L. Putnam's cold storage house, at Albion, Mich., was burned August 16; estimated loss, $22,000.

——In a large fire at Paulding, Ohio, July 23, C. A. Brewer's ice house and cold storage houses were burned.

——F. A. Millard's ice house at Independence, Mo., was burned August 9; loss, $5,500; insurance, $4,500.

——The ice house of the North Packing and Provision Co., Waltham, Mass., was burned July 27; loss, $12,000.

——Five ice houses of the Howard Ice Co., Newtonville, Mass., were burned August 1; loss, $5,000; insurance, $3,500.

——Geo. D. Shultz ice houses at Independence, Mo., were burned August 12; loss on houses, $2,000; insurance, $1,200.

——Jamison & Bond's ice factory at Rockaway Beach, N. Y., was burned July 22; loss, $30,000; only partial insurance.

——Johnson & Fletcher's and Jos. Herring's ice houses, at Great Falls, Mont., were burned August 13; loss, $4,000 each.

——The Consumers' Coal and Ice Co., Bayonne, N. J., was damaged $7,000 to $8,000 by fire August 11; insurance, $4,000.

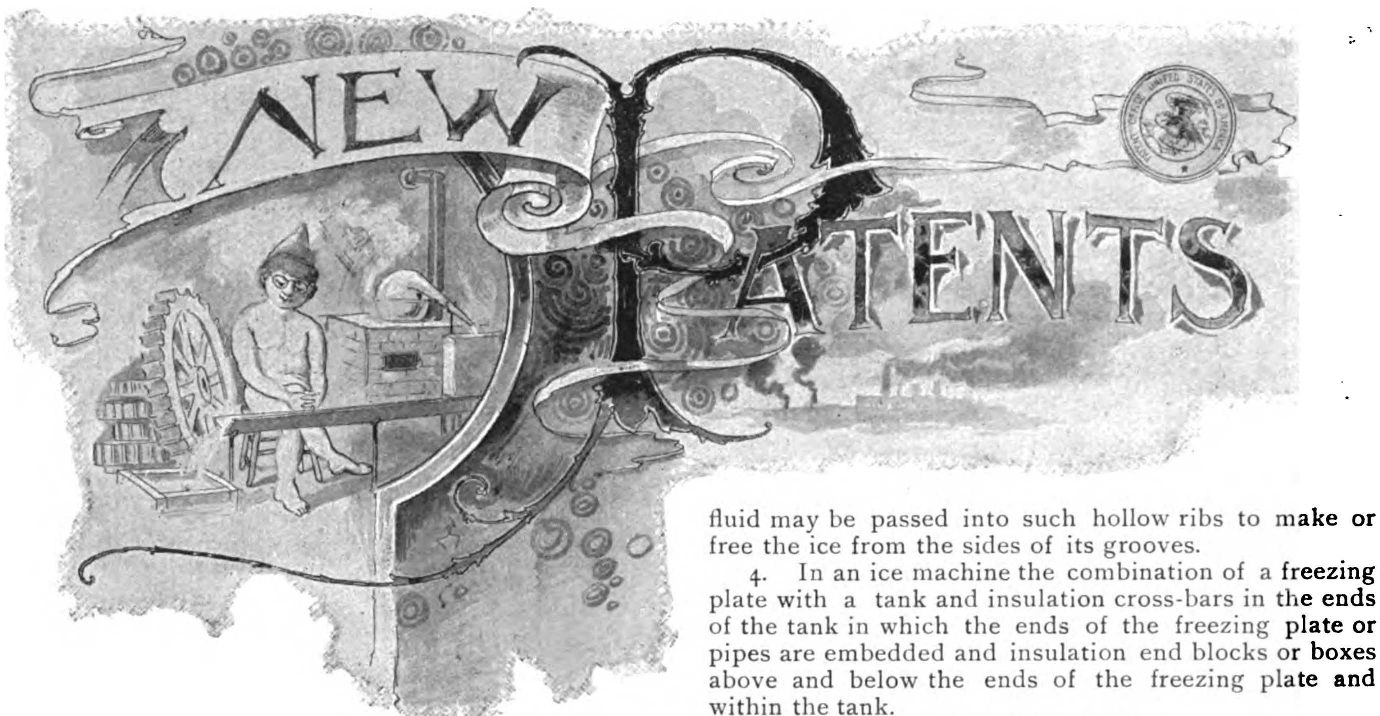
——The ice house, stable and slaughter house of Allison E. Yeager, Kimberton, Pa., were burned August 15; loss, $2,000.

——Doyle & O'Hare's ice house at Flint, Mich., was burned July 29, and 2,500 tons of ice destroyed; loss, $3,700; insurance, $2,500.

——The N.Y., P. & O. railroad ice house at Meadville, Pa., burned August 14, destroying a large portion of 200 tons of ice in store; loss, $650; no insurance.

——The plant of the Crystal Springs Ice Co., located two miles from Canton, Ohio, was burned August 10, and 45,000 tons of ice uncovered; loss, $18,000; fully insured.

——The ice houses of Nathaniel Webster at Day's Lower Pond, Lawrence, Mass., was burned August 16, and 5,000 tons of ice and a large value in wagons, sleds, tools and hay destroyed; loss, $15,000; insurance, $9,500.

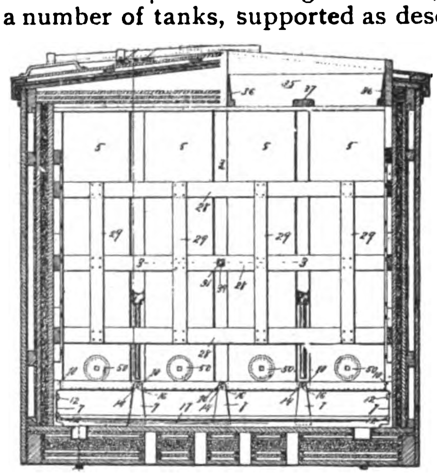


We append below the most important new patents relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for ICE AND REFRIGERATION.

REFRIGERATOR CAR.

No. 500,615. Thomas B. Roberts, Kansas City, Kan. Filed February 3, 1893. Serial No. 460,839. Patented July 4, 1893. (No model.)

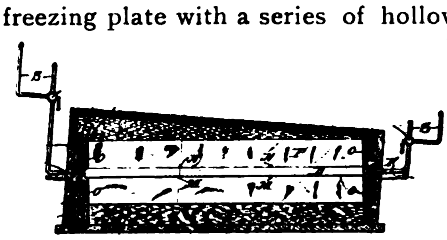
Claim.—4. In a refrigerator car, the combination of a number of tanks, supported as described, with vertical retaining rails secured to the walls of the car and having recesses or notches in their edges, and recesses or depressions extending downwardly from the rear ends of the first named recesses or notches, and a framework consisting of horizontal beams adapted to engage said recesses or notches and vertical beams or bars connecting said horizontal beams, and blocks secured at the inner sides of said horizontal beams and bearing against the inner or front sides of the tanks, and a tie bolt having one end passed through the said framework and engaged by a retaining nut, and its opposite end hooked, and an eye bolt secured to the wall of the car, and engaged by the hooked end of the tie bolt, substantially as set forth.



ICE MACHINE.

No. 501,045. George F. Knox, Chicago, Ill. Filed August 22, 1892. Serial No. 443,768. Patented July 4, 1893. (No model.)

Claim.—1. In an ice machine the combination of a freezing plate with a series of hollow longitudinal ribs therealong tapering toward their edges, between which the ice strips are frozen, with connecting pipes whereby the cooling or warming fluid may be passed into such hollow ribs to make or free the ice from the sides of its grooves.

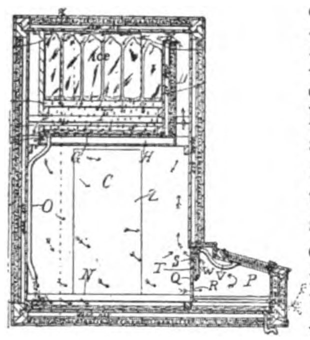


4. In an ice machine the combination of a freezing plate with a tank and insulation cross-bars in the ends of the tank in which the ends of the freezing plate or pipes are embedded and insulation end blocks or boxes above and below the ends of the freezing plate and within the tank.

REFRIGERATOR.

No. 501,249. John H. Hise, Los Angeles, Cal., assignor by mesne assignments, of one-half to George R. Shatto, same place. Filed September 21, 1892. Serial No. 446,472. Patented July 11, 1893. (No model.)

Claim.—1. A refrigerator comprising the combination of an ice chamber arranged at the upper portion of the refrigerator, closed throughout except an air inlet at the top and an air and drip outlet at the bottom, and having its floor arranged to allow the water from the melting ice to pass therethrough; the cooling chamber arranged in the lower portion of the refrigerator and having an open drip pan at the bottom thereof; an ascending warm air draft flue communicating between the top of the cooling chamber and the top of the ice chamber; the upper open drip pan arranged between the ice chamber and the cooling chamber at such a distance below the ice chamber as to provide a drip chamber of material depth so that the water falling from the ice chamber will create a downward draft of air from the ice chamber toward the bottom of the drip chamber; a cold air discharge communicating between the rear of the drip chamber and the rear top of the cooling chamber; the open lower drip pan arranged at the bottom of the cooling chamber, and the drip discharge arranged to discharge the drip from the upper drip pan into the cooling chamber and therethrough into the lower open drip pan.

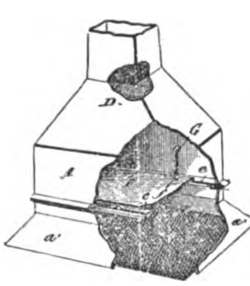


VENTILATOR FOR REFRIGERATORS.

No. 501,253. Joseph Netzer, Laredo, Tex. Filed September 2, 1892. Serial No. 444,901. Patented July 11, 1893. (No model.)

Claim—1. A ventilator for the purpose described, comprising a body portion having a hinged reticulated plate near the lower end, a reticulated plate near the upper end and an interposed loosely mounted valve, as set forth.

2. The combination with the body portion having a crimp, of a frame held in said crimp and provided with a soft covering to form a valve seat, and a loosely mounted valve above the seat and adapted to be actuated by hot air, as set forth.

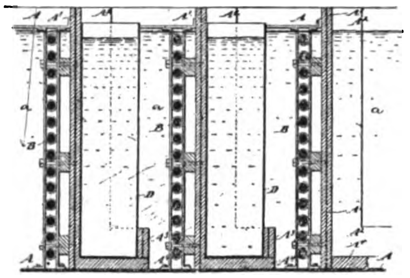


3. The combination with the body portion provided with a valve seat, of a valve arranged within the body above the said seat and provided with openings through which are engaged loosely rods held to the body whereby the said valve may move bodily vertically or as upon a pivot, as set forth.

BRINE TANK FOR ARTIFICIAL ICE MANUFACTURE.

No. 501,316. Louis Block, New York, N. Y. Filed October 31, 1892. Serial No. 450,418. Patented July 11, 1893. (No model.)

Claim—1. The brine tank A having the coils B and connections for inducing cold therein, in combination with non-conducting partitions A' permanently attached to and forming a part of the tank, and with means as the guides A^3 for holding ordinary ice forming cans in contact with such non-conducting partitions and allowing the ready insertion and removal of such cans, all substantially as herein specified.

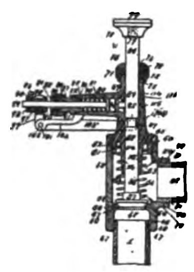


3. In ice making apparatus, the brine tank A, refrigerating coils B, non-conducting partitions A', upright cleats A^2, guides A^3 and floor planks A^4, all of wood or analogous non-conducting material, permanently attached and forming a part of the tank and arranged to form pockets therein out of contact with, but adjacent to the said coils, in combination with each other and with removable cans D of uniform thin metal, adapted to be easily inserted in and removed from the pockets formed by such non-conducting parts, all substantially as herein specified.

AUTOMATIC SELF-ARRESTER ICE CAN FILLER.

No. 501,398. Ferdinand Bauer, St. Louis, Mo. Filed March 8, 1893. Serial No. 465,173. Patented July 11, 1893. (No model.)

Claim—1. In an automatic self-arrester ice can filler, the combination of the major spring valve tube chamber 45, the automatic spring drop valve 58 in said chamber, the major plunger piston 56, having the lock slot 68 and the trip trigger 69; substantially as described.

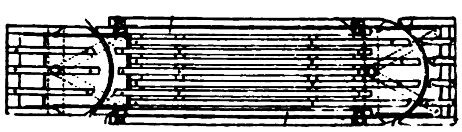


3. In an automatic self-arrester ice can filler, the combination of the water filler tube 1, the globe float 30, the swing ball 31, pivotally secured to said tube 1, the trip rod 41, the bell crank lever 100, the major spring valve tube section 45, the tubular trip head 59, the plunger piston 56, provided with the lock slot 68, the automatic valve 58, and the trip trigger 69, arranged to be sprung and trip the valve piston by said bell crank lever; substantially as described.

ICE RUNWAY.

No. 501,659. James Patterson, Jr., Albany, N. Y. Filed March 11, 1893. Serial No. 467,006. Patented July 18, 1893. (No model.)

Claim—1. A runway having a main framework consisting of sections arranged to automatically draw out and close in the direction of their length when in use in connection with a moving boat or similar object, and a swinging non-extensible end piece attached to one of the main sections of the framework, and automatically adjustable guide plates connected with the frame and swinging end substantially as described.

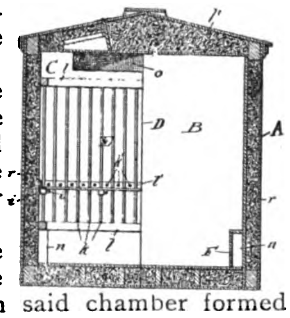


2. A runway having a framework comprising two laterally moving end pieces, movable supporting brackets arranged lengthwise of the sections, and friction reducing devices connecting the main portions of the framework substantially as described.

REFRIGERATOR CAR.

No. 502,662. William E. Eastman, Boston, Mass. Filed August 22, 1892. Serial No. 443,764. Patented August 1, 1893. (No model.)

Claim—1. In a refrigerator car, the combination with the ice storage chamber C of a vertically adjustable ice crib in said chamber, substantially as and for the purpose set forth.



2. In a refrigerator car, the combination with the ice storage chamber C, of an ice crib in said chamber having an adjustable base, substantially as and for the purpose set forth.

3. In a refrigerator car, the combination with the ice storage chamber C, of an ice crib E in said chamber formed with frames l and l' and bars k and k', the frame l' being supported and vertically adjustable on the bars k, substantially as and for the purpose set forth.

BOOK NOTICE.

THE MANUFACTURERS OF THE UNITED STATES. A classified and complete reference book for buyers and sellers for domestic and foreign trade. 150 Fifth avenue, New York: The Manufacturers Publishing Co., 4to, cloth, pp. 2105.

This is the third edition of this work, which is designed to bring together into one volume a complete list of manufacturers of the United States, as well as a guide to their products. The work must be conceded wonderfully complete, considering the magnitude of the task of compilation. The index of articles, or products of manufacture, alone occupies seventy-seven pages, running three columns of small type to the page; and this index seems to cover every article of commerce. This index refers to the page whereon the list of manufacturers of each particular article is given, with street number address as well as postoffice address. We have tested the references in many different lines, and have found few if any failures to find the firm name and address sought for by the test. After this general list, there is a trade list of the larger industries such as agricultural implements, boilers, cigars, etc., which list also seems remarkably accurate. The last department is that of advertisements and illustrations, also well indexed. The entire work shows unusual care in preparation, is very well printed, and exceptionally free from the annoying typographical errors which destroy any value which imitations of this work might have had were they as perfect in letter press as is this work.

CALIFORNIA EXPOSITION.

It is now positively announced that a "California Midwinter International Exposition" will be held at San Francisco from January 1 to June 30, 1894. The first official announcement says: "The site of this Exposition is located in Golden Gate park, and will cover an area of about 100 acres. There will be five principal buildings for the Midwinter Fair: (*a*) Manufactures and Liberal Arts, (*b*) Agricultural and Horticultural hall, (*c*) Mechanical Arts, (*d*) Fine Arts and Decorative Art; (*f*) Administration building. Applications are being received for separate and special constructions, such as: State exhibits, restaurants, reproductions, side shows, etc. M. H. de Young, vice-president of the national commission, World's Columbian Exposition, Chicago, will act as director general and president of the executive committee of the Winter Fair; the other members of the administration and officers are: Irwin C. Stump, vice-president; P. N. Lilienthal, treasurer; Col. A. Andrews, R. B. Mitchell, Hon. Eugene J. Gregory, Sacramento; Jacob H. Neff, Colfax; Fulton G. Berry, Fresno; J. S. Slauson, Los Angeles; Alexander Badlam, secretary; R. Cornely, assistant director general. Information for intending exhibitors, maps of the grounds, buildings, etc., may be obtained by applying to the department of publicity and promotion, California Midwinter International Exposition, Mills building, San Francisco, Cal.

——It is said that Swift and Armour, the Chicago packers, are to erect a number of tanneries on a 4,000-acre tract of land they have bought in Indiana. The capacity of the tanneries will be large enough to handle 90 per cent of all hides produced in the country. They have also bought large tracts of hemlock forest to furnish them with tanbark.

——The Llano (Tex.) Ice Co.'s fine ice plant, with bottling works, beer storage, stables, etc., was burned August 11; loss, $15,000; insurance, $3,500; cause, unknown.

——Four large ice houses, situated between Pleasure and Park islands, near Albany, N. Y., were burned August 1; cause, supposed incendiary; loss, nominal, the houses having been unused for two years.

——Ice houses, numbered 1, 2, 3 and 4, at Prosser Creek Ice Camp, near Floriston, Cal., were burned July 15. The houses contained 8,000 tons each, worth $60,000, while the houses were valued at nearly as much more. The cause of the fire is unknown. The fire may have a serious effect on the fruit trade, as the Union Ice Co. had intended to supply ice for fruit cars from their house.

——Philadelphia, or a certain section of that city, has been annoyed of late by repeated cases of petty thievery. The police finally arrested two men who were drivers for a local ice company. One of the two confessed, saying that they would find out that the houses were temporarily vacant, and report to the gang, who would at their leisure effect an entrance and carry off what plunder was in sight, subsequently dividing it.

WANTED AND FOR SALE ADVERTISEMENTS.

[The charge for advertisements in this column is $2 each insertion for seventy words or less, and twenty-five cents for each additional fourteen words. No advertisements will be inserted unless accompanied by the necessary cash. Parties answering these advertisements must write to the addresses given, as the Publishers decline to furnish any information concerning them.]

For Sale.

Good second-hand ice machine, in perfect running order. Address "P. K.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Ice For Sale.

50,000 tons of natural ice and a daily capacity of 50 tons artificial for sale at a bargain. Address, LAFAYETTE ARTIFICIAL ICE CO., La Fayette, Ind.

Partner Wanted

In a business that is already well established, and on a good paying basis, in a large and centrally located city. He must have from $5,000 to $10,000 to put into business. Write for particulars to "W. P. B.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

For Sale.

An absorption machine of thirty tons refrigerating capacity. Is in good condition and can be seen in operation at any time at the brewery of the undersigned. For particulars and price, address PIEL BROS., Liberty and Sheffield avenues, Brooklyn, N. Y.

Position as Engineer.

A practical engineer, who thoroughly understands ice making and cold storage, and who can do all repair work on machine as well as piping, wants situation. Compression system preferred. Can give best reference. Address "H. B.," 2400 So. Broadway, St. Louis, Mo.

Second-Hand Ice Machinery for Sale.

Two compression machines, one of 12-ton refrigerating capacity or 5-ton ice making, and one of 24-ton refrigerating capacity or 10-ton ice making, can be purchased for less than cost. They are guaranteed equal in every respect to the best new machines now on the market. Address for particulars, "S.W.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Salesman Wanted.

Wanted—A salesman to represent one of the best known ice and refrigerating machines now on the market. Will pay good salary to party who is well posted in the business and who has had experience and has an acquaintance with the trade. None but competent men need answer. Address, with full particulars, "X. Q. Z.," care of ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Ice Plant For Sale.

The subscriber offers for sale the whole of or a half interest in a paying ice factory in the state of Missouri. The plant has an 8-ton machine, which makes with ease 10 tons of ice daily; a never failing and ample supply of water; wagons, tools, etc. Trade is excellent and growing year after year. Plant is worth $15,000, but will sell whole or part at a bargain on account of bad health. Address "C. C. D.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Mechanical Engineer,

During the last twelve years in leading positions of prominent establishments for the manufacture of ice and refrigerating machinery, thoroughly acquainted with the requirements of the American market, as also with the latest improvements in foreign makes, in possession of a number of very valuable patents of recent date, requests parties interested to forward their address for further particulars. "S. P.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Ice Factory in Florida for Sale.

An ice factory in populous centre, with large retail and fishing industries, will be sold at a bargain. It has a 20-ton daily capacity and has paid 20 per cent on $60,000 for two years past. The owner is compelled to give his entire attention to other important enterprises in which he is engaged and must therefore sell. Cottages on ground for the workmen and their families. A large flowing artesian well of pure crystal water. For further particulars address "J. G. C.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

VOL. V. NO. 4. CHICAGO : NEW YORK : OCTOBER : 1893. $2.00 PER ANNUM.

[*Written for* ICE AND REFRIGERATION.]

INDICATOR DIAGRAMS.*

THE INDICATOR DIAGRAM AND ITS FAILURE TO SHOW TEMPERATURES—VARIOUS WAYS OF COMPRESSING THE AGENT—THE CONSTRUCTION OF CORRESPONDING DIAGRAMS.

BY GEO. RICHMOND, M. E.

THE indicator diagram is so well known and understood as to need no detailed description. It is, in effect, an autographic record of the work done in a steam engine cylinder or the compressor; but while the information afforded is of great use, it is by no means complete. We can determine in a compressor, for example, the pressure and volume of the ammonia at any given instant, but if we desire to know the temperature at the same instant, we have to resort to calculations or tables. Moreover, the changes in pressure and volume are brought about by addition or removal of heat, so that the complete record should give the following information:

1. Pressure; 2. Volume; 3. Temperature; 4. Work done on or by the ammonia; 5. Heat received or removed by the ammonia.

If in addition to the ordinary indicator we could construct a heat indicator which would record the temperature and sweep out an area representing the heat changes, just as the work indicator records the pressures and sweeps out the work area, then the substance itself would make a complete record, and very little calculation would be necessary.

Although a heat indicator is not a practical possibility, yet just as we construct a work diagram to indicate the work which will be done in a compressor under given circumstances, so we can construct a heat diagram to represent the heat changes which will take place; and the two diagrams will mutually assist each other in making clear the whole transaction.

There are several ways of compressing the agent in common use, or theoretically possible, constituting as many different cycles of operations.

(1) The warm liquid from the condenser is passed into an expansion cylinder, where it is cooled to the refrigerator temperature by doing work and partial volatilization. The remaining liquid passes into the refrigerator, and before completely evaporated the mixture is compressed without loss of heat during the compression. This is the "Carnot" cycle.

(2) The expansion cylinder is dispensed with in this and all following cycles, the liquid being injected into the refrigerator, the remaining operations being the same as in case (1). This is the Linde cycle.

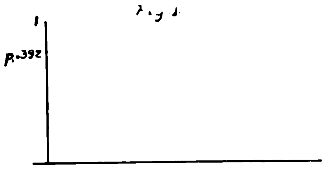
(3) The liquid is completely vaporized in the refrigerator, and compressed—(*a*) without removal of heat during compression; and (*b*) with partial removal of heat during compression.

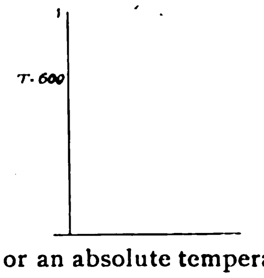
(4) The liquid is not only fully vaporized in the refrigerator, but superheated before compression, and then compressed—(*a*) without removal of heat during compression; and (*b*) with partial removal of heat during compression. Cases (3) and (4) are those most usual in American practice.

(5) The liquid is fully vaporized in the refrigerator, and during compression sufficient heat is removed to prevent either superheating or liquefaction during compression, so that the agent remains in the state of a dry saturated gas.

Each of these cases will be considered in its proper place; but for our present purpose we will take the last, for the reason that both the work and heat diagrams representing it can be constructed directly from the tables, and moreover these diagrams, when constructed, once for all, will, by suitable and easy modification, give those representing the other cycles.

Let us suppose that one pound of ammonia is operated upon in a cylinder having a piston area of one square foot; and, to make our standard diagram include all usual cases, we will take an extreme range of temperature, say 140°, for the condenser temperature and —40° for that of the refrigerator. To simplify matters, we will suppose that the ammonia never leaves the cylinder, but is heated and cooled by plunging the cylinder in a refrigerator and condenser alternately. We start then with a pound of ammonia in a liquid state and



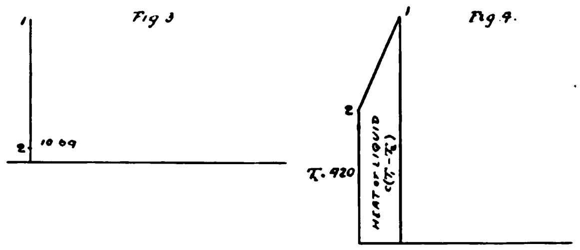


having a temperature of 140° F. or an absolute temperature of 460+140 = 600. From the tables of Prof. Wood, page 92 (which will be used throughout in these calcula-

tions), it is seen that at this temperature the pressure is 392 pounds per square inch. We commence our diagram by drawing a horizontal line, Fig. 1, for zero pressure and Fig. 2 for zero temperature. Any convenient scale for the two diagrams may be taken, say twenty pounds to the inch for pressure and one mm. per degree for the temperature. On the work diagram, Fig. 1, we set up a vertical line to represent the pressure, and on the heat diagram another to represent the temperature on the scales selected.

FIRST OPERATION.

Cooling the Ammonia.—The cylinder is plunged into the refrigerator where the ammonia within it is cooled down to —40°. If we knew accurately how much heat is removed from liquid ammonia for each degree of fall in temperature, we could represent the heat removed on

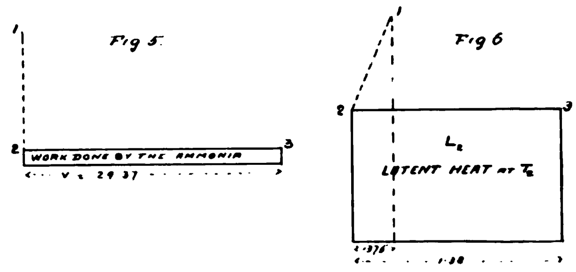


the heat diagram, Fig. 4, by causing the temperature ordinate to travel to the left (because heat is removed) so that it would sweep out the proper area for every degree it was shortened. Unfortunately we do not possess this information, and we will assume that a pound of ammonia loses one thermal unit for each degree of fall in temperature; in other words, that its specific heat is 1. Under these circumstances, the curve along which the extremity of the heat ordinate in Fig. 4 travels to reach the point 2, corresponding to a temperature of —40°, or 420 absolute, is one having the property that its area varies as the decrease in the length of the ordinate, which is the property of the logarithmic curve. The horizontal travel from 1 to 2 is equal to the difference between the logarithms (natural) of the respective temperatures. On consulting a table of natural or hyperbolic logarithms, we find that this difference is .357. If we agree to mark horizontal distance on the heat diagram to the centimeter scale, then we may set up 420 as a temperature ordinate, at a distance of 35.7 mm. from position 1; and for our present purpose it will be sufficiently accurate to join points 1 and 2 by a straight line If we assume the specific heat of ammonia to be [illegible] ss than 1, we must multiply the number [illegible] by [illegible] pecific heat chosen.

During this cooling of the ammonia the pressure will have fallen to 10.69 pounds per square inch, and as the volume is practically unchanged, the final point 2 on the work diagram will be found by marking off on the pressure ordinate the height equal to 10.69 pounds. This concludes the first operation, all the effects being represented by one or other of the diagrams, the area on the heat diagram representing the heat removed from the ammonia, while the work diagram shows no work, for the reason that there has been no perceptible change of volume.

SECOND OPERATION.

Vaporization of the Ammonia.—The cylinder is allowed to remain in the refrigerator until the ammonia has taken up sufficient heat to vaporize it completely at that temperature. By the tables we see that the quantity of heat taken up to effect the vaporization is 579.67 T. U. During this operation the temperature has remained unchanged, so that we may draw a horizontal line through



point 2 in Fig. 6 (and to the right this time, for heat is received) to represent the path of the ordinate 2 in sweeping out the heat area of this so-called latent heat. Since we know that this area is a rectangle having an area of 579.67 T. U., and that its height is 420, the length or travel of the ordinate must be

$$\frac{579.67}{420} = 1.38$$

The point 3 according to our scale will be 138 mm. from point 2.

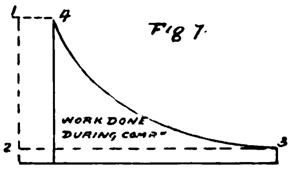
Turning now to the work diagram during the vaporization, the pressure will remain constant, so that we may draw a horizontal line through point 2 of Fig. 5. The length from 2 to 3 we can obtain from the table, from which we see that the volume of a pound of ammonia at —40° is 24.37 cubic feet, so that on our scale the pressure ordinate a^2 must travel this number of inches. The area of this diagram of work done by the ammonia, or rather by the heat imparted to the ammonia, is evidently the product of the pressure and volume, namely 10.69×24.37 foot-pounds. If we divide this quantity by 778, we obtain the number of T. U. which have been expended in producing the work. This would give us very nearly the number 48.23 of column 6. There is a trifling correction, however, to be made from the fact that the piston was not close up to the cylinder head when the vaporization commenced, so that the zero for volume ought to have commenced a little to the left of *A*. This distance can be found from the table; for by column 9 the volume of a pound of liquid ammonia at —40° is .0234 cubic feet. The true zero for volume then should have been .023 inches to the left of *A*, and the volume line for calculating the work diminished by that amount.

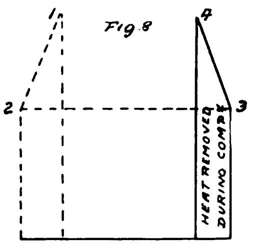
From the foregoing we see that the heat to vaporize a liquid, or the so-called latent heat, is partly transformed into work upon the piston. Since the remainder of the heat expended does not raise the temperature, which is the criterion of the reception of heat properly so-called, we may consider that it also is transformed into work of some kind, and for distinction it is called inner work or molecular work. These two quantities are known by various names, but no difficulty will arise if their relation is once understood. Sometimes that part of the latent heat converted into work done on the piston is termed the latent heat of expansion. Prof. Wood in his table names it the external heat, while the remainder is called by him the internal heat.

THIRD OPERATION.

Compression of the Ammonia.—The cylinder is now removed from the refrigerator, and work is done on the piston to raise its pressure to the initial pressure with which we started, namely, 392 pounds.

We suppose the ammonia to be compressed in such a manner that it remains all the time during the operation a separate vapor. In order to do this heat must be removed during the process of compression, and we may imagine this to be done by means of a jacket around the cylinder communicating with the refrigerator. During this process the pressure and volume will both vary, but we can plot a curve that the pressure ordinate will



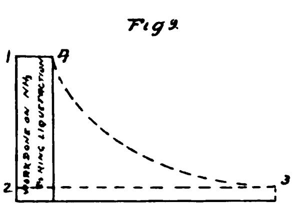


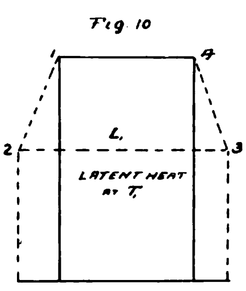
follow on the work diagram, Fig. 7, in traveling from point 3 to point 4 from the tables. Column 4 gives the pressure corresponding to the volume in the same line found in column 8, from which we can get as many points as we choose for the curve. When the final pressure is reached at 4, the compression will continue at the same pressure; this part of the diagram, however, belongs to the next operation.

Turning now to the heat diagram, Fig. 8, the temperature ordinate 3 will travel to the left (since heat is now removed) and will increase in height during its progress until at the point 4 it reaches the initial temperature at which we started, namely 600° absolute. The area it sweeps out in traveling from 3 to 4 represents the quantity of heat removed by the agent in order that the gas may remain dry and saturated during compression. Later on we will trace this curve; at present it is sufficient to find the position of the final point 4; we can then join 3 and 4 by a straight line. The length from 1 to 4 can be found as follows: It is one side of a rectangle, which evidently represents the latent heat at 600°, which from the table we find to be 465.39. and its length is therefore $\frac{465.39}{600} = .776$. If we measure a horizontal line 77.6 mm. long from point 1, we shall reach the point 4.

FOURTH OPERATION.

Liquefying the Ammonia.—The cylinder is now placed in the condenser, and the ammonia within it is gradually reduced to a liquid at constant pressure and constant temperature. We may draw horizontal lines through point 4 in both the work and heat diagrams until point 1 is reached, from which we started, and the cycle is





now complete. The work done during this operation is the area swept out by the ordinate 4 in passing from 4 to 1. The heat removed is the area swept out by the ordinate 4 in passing from 4 to 1 on the heat diagram, being, as before noticed, the latent heat at the condenser temperature.

We have now on our two diagrams a complete record of the process of refrigeration as carried out in the compression system. A certain amount of heat has been taken in at the low temperature and a certain quantity has been discharged at the high temperature. As the work diagram shows, there has been work done on the piston and by the piston, the net work done by the engine being the well known closed area 1, 2, 3, 4, 1 on the work diagram. It is also evident from the heat diagram that more heat has been discharged than has been received, the surplus being the heat area of the closed surface, 1, 2, 3, 4, 1. Evidently these two closed areas must be equal in area when reduced to corresponding units; that is to say, the area of the work diagram reduced to thermal units must be the same as the heat area, or, *vice versa*, the area of the heat diagram reduced to foot-pounds must be the same as the work area. This relation is of great importance and renders great assistance in obtaining our results, for we can choose whichever of the two areas is the more easy to measure.

THE necessities of war have not infrequently led to valuable discoveries of a practically scientific character, says a writer in *Youth's Companion*. Of late the French minister of war has been studying the subject of ice from the point of view of its capacity to maintain weights. He has found that when ice has become about an inch and three-fifths (four centimeters) thick, it begins to bear the weight of a man who is marching alone. At a thickness of something over three and one-half inches (nine centimeters) it will bear files of infantry. When it has become twelve centimeters, or nearly four and three-quarters inches thick, it sustains light artillery or carriages, and at twenty-nine centimeters, or about eleven and four-tenths inches, it bears the heaviest weight that the transporting of an army requires. These conclusions of the French military authorities may have some interest for skaters, but it should be remarked that they apply only to young ice. Successions of colder and warmer weather, in the course of a few weeks, produce a change in the structure of ice which greatly weakens its power of resistance to pressure. Accordingly, the measurements and estimates given above should not be trusted in the case of ice that is not of recent formation.

THE editor of the "leading daily" in a southern town comments on the completion of a new factory in his town in this wise: "As they have not had the decency to send a carriage to take us out to the factory we have not given our readers a more detailed account of their operations. It is too far off for us to walk there, this hot weather." "They" should hire the carriage forthwith, or his neighbor across the way will imitate some of "us literary fellows" up north, who insist on hacks and champagne suppers for less cause than opening an icefactory!

THE wise ice dealer will not wait until cold weather before presenting his bill, says the cute paragrapher. True. He was much wiser who tackled the paragrapher as often as once a month.

—Sam'l V. Crane has retired from the firm of Maxon Bros. & Crane, at Blackstone, Mass., and will devote his time to the ice business.

OBITUARY,

THE LATE E. V. CLEMENS—SKETCH OF HIS CAREER AS CIVIL AND MECHANICAL ENGINEER—OTHER OBITUARY NOTICES.

E. V. Clemens, superintendent of the De La Vergne Refrigerating Co., New York, died at his residence, 250 Willis avenue, in that city, Sunday morning, September 3, from pleuro-pneumonia, after an illness of three weeks. He was thirty-eight years and five months old. Mr. Clemens was also, at the time of his death, consulting engineer of the Central Forge Works and treasurer of the White Cloud Copper Mining Co., both of which corporations, as well as the De La Vergne company, bear testimony to the happy influence of his interest and co-operation.

Mr. Clemens was born in Waterbury, Conn., his ancestry being traceable back to American colonial days. His father came from the well known Clemens family, of Stratford, Conn., while his mother was connected with the Girards, of which family the famous Philadelphia merchant and philanthropist, Stephen Girard, was a member. Mr. Clemens' father, A. B. Clemens, who was superintendent of the Farrell Foundry and Machine Co., was at first inclined to have the young man, born an engineer, study law, while his good mother, woman-like, would have preferred to consecrate him to the church; but the boy's own choice was mechanics, and his father accordingly took him into the shops of the Farrell company, where he obtained the technical education which was the foundation on which he built his subsequent career as a civil engineer, his course in the foundry and machine shop having covered the practical work of pattern maker, foundry man, machinist and draughtsman.

THE LATE E. V. CLEMENS.

His first success as civil and mechanical engineer was the installation of a sugar plant on an estate in Cuba, for his life-long friend, Santiago W. Mellor; after which he was for a number of years superintendent of the National Machine Co., Tiffin, Ohio; the Clemens Foundry and Machine Co., Ansonia, Conn., the Farrell Foundry and Machine Co., Ansonia, Conn., and for the past five years superintendent of the De La Vergne Refrigerating Machine Co., and, later, treasurer of the White Cloud Copper Mining Co., both of New York city, of which concerns he was one of the leading managerial spirits.

He was a well known member of the American Society of Mechanical Engineers; of American Society of Civil Engineers; the Engineers' Club, the Old Curiosity Club, Schnorer Club and Technischer Verein, of New York city.

A lover of and a shining light in his professions, of art as well as of nature, and a microscopist of more than ordinary ability, he was well known to many, but was held especially dear by those privileged to be close to him, as a man of the stanchest friendship, and the embodiment of all that is manly, noble and gentle; while his genial manner and jovial nature drew to him every one who came in contact with him. They who knew him best most keenly feel his loss. He left behind a wife and three children. The funeral services were held in Bethany church, on 137th street near Willis avenue, on Tuesday morning, September 5, and were attended by friends and relatives, also by the officers of the companies in which he was interested, as well as the employes of the De La Vergne company. The interment took place in Pine Grove cemetery, Ansonia, Conn., on the same day at 4:00 o'clock P. M.

OTHER OBITUARY NOTICES.

——Boyle Maginnis, for many years president of the Lincoln Ice Co., Chicago, died September 6, after a long illness. He was fifty-five years of age and long a resident of Chicago. He leaves a widow and six minor children.

——E. D. Tuttle, proprietor of the cold storage, of Hornellsville, N. Y., died recently of heart disease.

——Luke Lascelles, of Cleveland, Ohio, was drowned in August last while bathing. He was one of the original owners of the "Arctic" ice and refrigerating machine and well known to the trade some years ago.

——Thos. B. Vinton, of Braintree, Mass., was burned to death September 3, by the explosion of a barrel of gasoline. He was seventy-five years of age, and leaves a widow and family of adult children. He was once an ice dealer in Braintree.

——W. W. Barker, of Seattle, Wash., died in August last, of consumption. Mr. Barker was born at Gardiner, Me., April 3, 1839, from which place he moved to Seabeck, Wash., in 1864 to assume the position of storekeeper for Blinn & Adams. After ten years in that place he moved to Seattle and went into the ice business, forming the firm of Blinn, Page & Barker. It is said that the firm was the first to introduce ice from California. After several years the firm was changed to Horey & Barker, with headquarters on Commercial St. Of late years Mr. Barker had led a retired life.

——Henry Reynolds, one of the heirs of the late Robert Reynolds, of the Stone Lake Ice Co., Cincinnati, September 11 filed his papers bringing suit for a partition of the estate, he claiming a one-fifth part, and in case a partition cannot be had he asks for a sale of the property. He says his share is incumbered by a $5,000 mortgage, the signature to which was obtained by false and fraudulent representations. Mr. Reynolds stated he never received a single cent in consideration thereof, and never met the mortgagee.

——The De La Vergne Refrigerating Co., of New York, September 1, filed a bill at Chicago to secure an accounting with the Produce Cold Storage Exchange on West Lake street. The bill recites that the two companies entered into a contract February 9, 1892, whereby the complainant agreed to place a refrigerating concern in the cold storage warehouse for $54,592.44. It declares that $11,381.76 yet remains due. The removal of George M. Moulton, the president of the defendant company, who was recently appointed receiver to wind up its affairs, is asked for.

——Fred Carter, of West Pembroke, Me., and Frank Lyons, of Dennisville, Me., were arrested at North Andover, August 29, charged with embezzlement. Both had been employed by Frank M. Greenwood, ice dealer at Lawrence. Complaints had been made to Mr. Greenwood by customers that they were not receiving the proper amount of ice. An investigation proved, it is alleged, that Carter and Lyons were in the habit of giving the customers reduced weight and selling the remainder of the ice, pocketing the money. They were arraigned before Judge Weil, and were each fined $20, which they paid.

Let the loss of pressure on the suction side amount to 1.80 pounds per square inch, and that on the delivery side to 2.25 pounds,* and let the period for isothermal compression amount to 40 per cent of the stroke, then the sum of these losses in pressure will be 2.70 pounds per square inch on the piston for the entire stroke. For a mean indicated pressure of 27 pounds for sulphurous acid, 56 pounds for ammonia and 330 pounds for carbonic acid, the losses by pressure result respectively as 14.8 per cent, 5.0 per cent and 0.8 per cent.

Sulphurous Acid.—This fluid offers in none of the directions just discussed any advantage as to efficiency in comparison with ammonia: on the contrary, the previous considerations demonstrate the actual efficiency of the sulphurous acid machines to be far behind that of ammonia machines, and such has also been established by the exhaustive comparative tests made under Schroeter's direction in the years 1886 89 on several Pictet machines, which have been published in the reports repeatedly referred to in this paper.

Carbonic Acid.—As regards carbonic acid machines, it must be regretted that actual results have hitherto not been published. Observations from private tests which have come to the author's knowledge entirely confirm what has been said before. The efficiency differs but slightly from that of ammonia machines as long as the range of temperature is very small; but with increasing temperature the efficiency decreases (as per table IV), so rapidly that, for instance, for a refrigerator temperature of 14° F., and a cooling water temperature initially of about 60° F., the consumption of power for a carbonic acid machine (producing an equal quantity of cold) is at least 50 per cent greater than for an ammonia machine.

Ammonia.—Considerations as to the physical properties of ammonia and the results of reliable tests hitherto published, confirm that ammonia compression machines show the highest efficiencies among the various refrigerating machines for all temperature ranges possessing practical importance. There may be other justifiable reasons rendering for certain special circumstances the use of cold air machines, carbonic acid machines, and absorption machines preferable, but then the attainment of the highest possible efficiency must be a second consideration.†

* These are values corresponding to measurements on well constructed compressors working at moderate speed (*vide* the publications by Schroeter, previously referred to).

† It is not meant to be conveyed that *every* ammonia compression machine is superior to any absorption or carbonic acid machine. The difference in the actual efficiency of different machines belonging to one and the same system is sufficiently great to enable a well constructed absorption or carbonic acid machine to be far superior to a badly built ammonia compression machine. What is here said refers expressly to machines of equally good construction.

Reprinted from ADVANCE SHEETS.]

THE REFRIGERATING MACHINE OF TO-DAY.

GREAT INCREASE RECENTLY IN REFRIGERATING MACHINES—DIFFICULTY OF REACHING A FINAL DECISION ON THEIR MERITS —FRICTION—LOSSES IN PRESSURE, ETC.

BY C. LINDE, MUNICH, GERMANY.

[*Concluded from September number, page 176.*]

THE amount of loss in efficiency due to friction is rightly considered as being dependent on the dimensions of the compressors as they are determined by the various fluids.

It is well known that this point forms one of the main causes for the relatively large motive power required by ether machines, for which the frictional work amounts to from 20 to 30 per cent of the indicated work. For sulphurous acid machines Schroeter* has found the former to be 10 to 11 per cent, and for Linde ammonia machines 5 to 7 per cent. The question arises: "Can any further economy be secured by the adoption of carbonic acid?" The answer will be in the negative.†

LOSSES IN PRESSURE.

Valve Resistance.

The influence of the losses in pressure is, however, not insignificant, *i. e.*, the difference between the refrigerator pressure and the pressure in the compressor during the aspiration period and that between the condenser pressure and the pressure in the compressor during the period of isothermal compression. If these respective pressure lines are drawn upon the indicator diagrams, it is at once plain that the areas of loss are the larger, the smaller the mean pressure will be; and this may be figured approximately as follows:

* *Untersuchungen an Kaltemaschinen*, Munich, 1887, pp. 117-139; *Vergleichende Versuche an Kaltemaschinen*, Munich, 1890, pp. 65 79.

† The dimensions of the ammonia compressors are already so small that, as a rule, their length of stroke is retained also for carbonic acid, because any diminution of the stroke would act unfavorably upon the clearances, and would subject the driving gear to comparatively large stresses. For the same stroke the strains transmitted by the piston upon the driving parts, and consequently also the friction in main bearings, crank pin and slides, will be somewhat larger (for reasons stated) than for ammonia. The piston ring friction might, on account of the smaller circumference of piston, be a trifle less for carbonic acid, but this is balanced by the increased friction of the piston rod due to its having to be packed against high pressure.

CONCERNING TEST TRIALS ON REFRIGERATING MACHINES.

The further elucidation of questions dealing with the actual efficiency of refrigerating machinery is dependent on the exact performance of test trials. For a comparison between the results thus obtained, it is not only of value to know them as being derived from quite correct measurements, but these last must be carried out on a *common basis*, so that the test programme will be one and the same for certain important points. For similar purposes (for instance, for evaporation tests on steam boilers, for efficiency tests on steam engines, for trials on pumping engines) the engineering profession has agreed to the adoption of standard testing rules. It would be of the highest importance for the field of refrigerating machines, if such a programme would meet with the consent of all concerned, in order that the same may be applied in all cases where it is intended to compare the trial results with those obtained elsewhere.

General Programme.—The author submits here his suggestions for a standard programme, and invites discussion on the main points to be considered. The following questions will have to be dealt with:

"What shall be measured?"

"How shall the measurement be made?"

"How are the results to be tabulated and utilized for purposes of comparison?"

A reply to the first two questions will be found on considering that the purpose of the test is to determine the ratio of consumption and production, so that there will have to be measured both the refrigerative effect and the heat (or mechanical work) consumed, also the cooling water. By *refrigerative effect* is understood the product of the number of heat units (Q) which are abstracted from the body to be cooled, and the quotent $\frac{T_c - T}{T}$; that is to say, the difference between the temperature T_c at which the heat is transmitted to the cooling water, and the temperature T at which the heat is to be taken from the body to be cooled, divided by this latter (absolute) temperature.

The determination of the *quantity of cold* will be possible with the proper exactness only when the machine is employed during the test to refrigerate a liquid, and if the cold be found from the quantity of liquid circulated per unit of time, from its range of refrigeration, and from its specific heat. Sufficient exactness cannot be obtained by the refrigeration of a current of circulating air, nor from the manufacture of a certain quantity of ice, nor from a calculation of the fluid circulating within the machine (for instance, the quantity of ammonia circulated by the compressor). Thus the refrigeration of brine will generally form the basis for tests making any pretension to accuracy; at the same time, the degree of refrigeration should not be greater than necessary for allowing the range of temperature to be measured with the necessary exactness; for this a range of temperature of from 5° to 6° F. will suffice.

The same reasoning will apply to the *condenser measurements* for cooling water and its temperatures; these will be possible with sufficient accuracy only with submerged condensers, seeing that for evaporative surface condensers atmospheric influences play a part which cannot be taken into account with sufficient certainty. The measurement of the *quantity of brine* circulated, and of the cooling water, is usually affected by water meters inserted into the conduits. If the necessary precautions are observed this method is admissible. For quite precise tests, however, the use of two accurately gauged tanks must be advised, which are alternately filled and emptied.

To measure the *temperatures of brine and cooling water* at the entrance and exit of refrigerator and condenser respectively, the employment of specially constructed and frequently standardized thermometers is indispensable; no less important is the precaution of using at each spot simultaneously two thermometers, and of changing the position of one such thermometer series from inlet to outlet (and *vice versa*) after the expiration of one-half of the test in order that possible errors may be compensated.

It is hardly necessary to point out the importance of determining with thorough precautions the *specific heat of the brine* used in each instance for its corresponding temperature range, as small differences in the chemical composition and the concentration of the brine may cause considerable variations. In every instance the nature of the brine and its concentration should be entered in the report.

As regards the *measurement of consumption*, the programme will not have to lay down any special rules in cases where only the measurement of steam and cooling water is undertaken, as will be mainly the case for trials of absorption machines. For compression machines matters lie less simply, because with them the steam consumption depends both on the quality of the steam engine and on that of the refrigerating machine, while it is evidently desirable to know the consumption of the former separately from that of the latter. As a rule, steam engine and compressor are coupled directly together, thus rendering a direct measurement of the power absorbed by the refrigerating machine impossible, and it will have to suffice to ascertain the indicated work both of steam engine and compressor. By further measuring the work for the engine running empty, and by comparing the differences in power between steam engine and compressor resulting for wide variations of condenser pressures, the effective consumption of work L_e for the refrigerating machine can be found very closely. In general, it will suffice to use the indicated work found in the steam cylinder, especially as from this observation the expenditure of heat can be directly determined. Ordinarily the use of the indicated work in the compressor cylinder, for purposes of comparison, should be avoided; firstly, because there are usually certain accessory apparatus to be driven (agitators, etc.), belonging to the refrigerating machine proper, and secondly, because the external friction would be excluded.

Heat Balance.—We possess an important aid for checking the correctness of the results found in each trial by forming the balance in each case for the heat received and rejected. Only such tests should be regarded as correct beyond doubt, which show a sufficient conformity in heat balance. It is true that in certain instances it may not be easy to account fully for the transmission of heat between the several parts of the machine and its environment by radiation and convection, but generally (particularly for compression machines) it will

be possible to obtain for the heat received and rejected a balance exhibiting small discrepancies only.

REPORT OF TEST.

Reports intended to be used for comparison with the figures found for other machines will therefore have to embrace at least the following observations:

Refrigerator:

- Quantity of brine circulated per hour..................
- Brine temperature at inlet to refrigerator..............
- Brine temperature at outlet of refrigerator..... ......*t*
- Specific gravity of brine (at 64° F.)....................
- Specific heat of brine...................................
- Heat abstracted (cold produced)......................Q_e
- Absolute pressure in the refrigerator ....

Condenser:

- Quantity of cooling water per hour................ .....
- Temperature at inlet to condenser.....................
- Temperature at outlet of condenser...................*t*
- Heat abstracted....................................Q_1
- Absolute pressure in the condenser.....................
- Temperature of gases entering the condenser...........

ABSORPTION MACHINE.

Still:

- Steam consumed per hour..
- Absolute pressure of heating steam....................
- Temperature of condensed steam at outlet...........
- Heat imparted to still. .Q'_e

Absorber:

- Quantity of cooling water per hour ....
- Temperature at inlet........
- Temperature at outlet......
- Heat removed...........Q_2

Pump for Ammonia Liquor:

- Indicated work of steam engine....................
- Steam consumption for pump
- Thermal equivalent for work of pump............$A\ L_p$
- Total sum of losses by radiation and convection $\pm Q_3$

Heat Balance:

$Q_e + Q'_e = Q_1 + Q_2 \pm Q_3$.

COMPRESSION MACHINE.

Compressor:

- Indicated work..........L_t
- Temperature of gases at inlet......................
- Temperature of gases at exit

Steam engine:

- Feed water per hour........
- Temperature of feed water.
- Absolute steam pressure before steam engine.........
- Indicated work of steam engine..................L_e
- Condensing water per hour..
- Temperature of water per hour......................
- Total sum of losses by radiation and convection $\pm Q_3$

Heat Balance:

$Q_e + AL_e = Q_1 \pm Q_3$.

For the calculation of efficiency and for the comparison of various test results, the actual efficiencies must be compared with the theoretical maximum of efficiency $\left(\frac{Q}{AL}\right)$ max. $= \frac{T}{T_c - T}$ corresponding to the temperature range.

Temperature Range.—As temperatures (T and T_c) at which the heat is abstracted in the refrigerator and imparted to the condenser, it is correct to select the temperature of the brine leaving the refrigerator and that of the cooling water* leaving the condenser, because it is in principle impossible to keep the refrigerator pressure higher than would correspond to the lowest brine temperature, or to reduce the condenser pressure below that corresponding to the outlet temperature of the cooling water.†

Some reports on test trials contain as temperature limits the temperatures corresponding to the actual gauge pressures observed in the condenser and refrigerator. But such a method does not take into account the real temperature range, as it is prescribed by the requirements of each case; temperature ranges are rather introduced which are created by the machine itself. It is universally recognized that (under otherwise equal conditions) that machine will possess the highest efficiency for which the refrigerator pressure corresponds as nearly as possible to the temperature down to which the body to be cooled is refrigerated, and for which, in like manner, the condenser pressure corresponds most closely to the outlet temperature of the cooling water. If, for judging the machines, the actual pressures were chosen as a starting point, just those machines would appear to be frequently credited with the higher efficiency, the performances of which—as a consequence of the imperfections present—are less satisfactory.*

Even the proper comparison between the performances of one and the same machine working under the same external but different internal conditions, is rendered misleading by the method here referred to. Assuming an ammonia compression machine to work uniformly at a certain brine temperature and a certain outlet temperature of cooling water, but receiving in one case wet and in the other dry vapors, in the latter case the refrigerator pressure will be less and the condenser pressure higher than in the former case. It is evident that in both instances the required duty consists in lifting the heat to be abstracted from the same lower to the same higher temperature level, and that we can estimate the influence created by the different working processes correctly only by taking into account the levels prescribed from the outset, and not the fluctuating levels dependent on the fluctuations to which the ammonia has been subjected. Such a method may be serviceable for ascertaining the efficiency of single parts of the refrigerating machine—for instance, of the compressor—but not for the determination of the efficiency of the entire machine. Certainly it should not be neglected to record the pressures in refrigerator and condenser; but, valuable as these observations may be for the investigation of the several single performances carried out in the machine, it is necessary always, for comparing the true refrigerative effects of different machines, to start from temperatures which are independent of the class and

* The (theoretically) attainable lowest limit of the outlet temperature (for submerged condensers) will be the temperature corresponding to the transmission of heat to the cooling water equal to the cold produced ($\mathfrak{Q}$), plus the heat equivalent to the mechanical work $AL = \mathfrak{Q}\frac{T_c - T}{T}$. In compression machines the sum $\mathfrak{Q} + AL$ is influenced so slightly by the deviations of the actual work from the theoretical work, that we may unhesitatingly select as starting point the actual outlet temperature. In absorption machines, however, this is permissible only when the cooling water is passed first through the condenser, and afterward through the other apparatus.

† While it is requisite to look upon the outlet temperature of the cooling water (on account of the pressures, as the constant rejection temperature for the principal part of the heat to be abstracted (*i. e.*, the latent heat), it is true that for a small portion of the heat to be removed (*i. e.*, the part serving to reduce the liquid heat), the initial temperature of the cooling water can be considered as the determining feature.

* The publication by Denton and Jacobus, already referred to (*Trans. Amer. Soc. Mech. Engrs.*, Vol. XIII), contains an instance of erroneous conclusions drawn from this latter method of selecting the temperature range. For the Pictet machine and the Linde ammonia machine tested at Munich under Schroeter's direction, the temperatures resulting from the refrigerator and condenser pressures are employed by the reviewers for the determination of the efficiencies, although it had been expressly prescribed from the outset and carried out during the tests, that both machines should refrigerate the same brine through the same range of degrees down to the same temperature, and that the cooling water should enter and leave the machines at the same respective temperatures. Under these conditions the Pictet machine received per 1,000 B. T. U. in the average sixty-three pounds, and the Linde machine in the average fifty-nine pounds. (Denton and Jacobus represent the Pictet machine as having received less cooling water, evidently mistaking the absolute quantities for the relative amounts.) Hence Denton and Jacobus are led to find from these calculations nearly the same efficiency for both machines, while the actual surplus in efficiency of the ammonia machine amounted from twenty per cent to thirty per cent beyond that of the Pictet machine, according to the plain statement of Schroeter, accepted by Pictet.

If, in the Pictet condenser, the difference between the temperature corresponding to the condenser pressure and the outlet temperature of the cooling water had been still greater, that is to say, if the process performed by the Pictet machine had shown still greater imperfections, the efficiency would probably, according to Denton and Jacobus' method, have resulted as being higher, or at least equal to that actually found. Hence the necessity for an accurate and definite conception of "refrigerative effect" and the corresponding "ranges of temperature."

construction of the machine and which are specified by the outside conditions of each case; just as for judging a water works plant we start invariably from the really required height of lift, and not from any pressures which may be present at some particular point of the system.

We have therefore to insert into the formula for the theoretical maximum efficiency:

$$T_e = 460 + t_e \text{ F., and } T = 460 + t^\circ \text{ F.}$$

The ratio n between the actual and the theoretical maximum will thus follow:

$$e = \frac{Q_e}{AL_e} : \left(\frac{Q}{AL}\right) \text{max.} = \frac{Q_e}{AL_e} \times \frac{t_e - t}{460 + t}$$

But for purposes of comparison between compression and absorption machines there must be introduced the actually spent quantity of heat $Q'_e = \frac{1}{u} AL_e$, and we obtain for the comparison of two different machines of each kind the ratio:

$$e_e = ue = \frac{Q_e}{Q'_e} \times \frac{t_e - t}{460 + t}.$$

[*Reprint from* TRANSLATION.]

FUEL SAVING.*

FUEL CONSUMING PLANTS AND HOW TO UTILIZE THEM—VALUES OF COALS—LOSSES OF THEORETICAL VALUES IN ACTUAL PRACTICE OF COMBUSTION.

BY PROF. FRANZ SCHWACKHOEFER.

EVERY article of fuel during combustion gives off a certain amount of heat, which it is customary to express in calorics, or in units of evaporating power. For instance, certain kinds of coal have an evaporating value of 10 to 12; that is to say, one kilogram of this coal is sufficient, supposing all its heat to be utilized, to transform 10 to 12 kilograms of water of ordinary temperature into free steam of 100° centigrade. Coal of less value has an evaporating power of only 8 to 9; brown coal of superior quality, 6 to 7; and of inferior quality, 4 to 5.

These theoretical values cannot be obtained in practice. In every heating plant, no matter what its construction, certain losses of heat are unavoidable. These losses are caused by—

1. The escape of gases produced by combustion, while possessing a high temperature, which we call the heat lost in the smokestack.
2. Imperfect combustion.
3. Loss of heat produced by contact with other bodies and radiation.

The loss through the smokestack usually is by far the greatest of all. It depends upon—

a. The amount of air used for combustion, and

b. The temperature at which the gases produced by combustion leave the combustion chamber.

As regards the amount of air, it may be observed that all combustion requires a certain amount of air; that is to say, more air must be introduced than is absolutely necessary for combustion. The more this excess of air can be kept down, the greater will be the yield of heat obtained. Where gas or half-gas fuel is used, it will be enough to have one and one-fourth to one and one-half of the amount of air calculated theoretically; that is, if the chemical analysis shows that one kilogram of coal requires, say 10 kilograms of air, it is practically sufficient to have 12½ to 15 kilograms. Where solid fuel is used for direct heating, as is the case in the ordinary grate furnaces, a much larger amount is required, often twice or two and a half times the amount of air, since the mixture of the gases escaping from the coal can never be so intimate as where the gases are supplied ready for combustion. In reducing the excess of air much depends upon the size of the lumps of coal as well as the matter of firing. The more the coal requires oxygen for combustion, the more the coal should be broken up. The influence of the size of the lumps is much greater than is generally believed. In ordinary plants the coal must be spread as evenly as possible on the grate. In passing through the bed of coal, the air has to overcome a certain amount of resistance, which is the greater the more densely the coal is packed. Where the heaviest layer of coal is piled up, there the greatest amount of air ought to pass through. Where the coal is not evenly spread on the grate, however, the contrary takes place. The air will naturally take the road where it meets with the least resistance. If there are vacant spots on the grate, or spots where the bed of coal is thin, these will afford an opportunity for large amounts of air to pass which not only remain entirely without effect upon the maintenance of the fire, but, in addition, will carry off large quantities of heat; whereas, in those places where the bed of coal is thick, the lack of air will cause only dry distillation and imperfect combustion to take place. It is thus quite a common occurrence that a furnace is supplied with excessive quantities of air, and, nevertheless, smoke and soot will be formed.

It is exceedingly difficult to fire properly, and in large establishments it is simply impossible. It follows that the ordinary grate firing is one of the most imperfect technical operations that can be imagined. All improvements that have been made for the purpose of being independent of the fireman have failed, and in this respect we occupy to-day a very low stage of development. In all branches of industry, and in all parts of them, the most complete utilization of the raw material is aimed at; yet in this particular direction countless millions are wasted year after year. Some years ago it was not known that these enormous losses did exist; yet when research taught us to appreciate the conditions of our heating plants no remedy was suggested that proved successful. It was considered sufficient to obtain 40 or 50 per cent of the heat from the material. We know to-day, however, that it is possible to obtain and put to use 80 to 90 per cent; that is to say, that we can save more than one-third, and in some cases one-half, of the coal.

The first requisite condition is to abandon our primitive grate fires and replace them by a technically perfect arrangement. Efforts made in this direction up to the present time have not obtained any general success. In certain industries, notably in metallurgy, glass and porcelain factories, water gas and generated gas have done good service as fuel, and are used quite extensively. But for the most important and by far the most

* A paper read by the author at the International Brewmasters' Congress held in Chicago, September 13, 1893. The author introduces the paper by expressing his thanks for the honor of the invitation to read the paper; by noting the differences between continental and American methods, the former slow and conservative, the latter stirring, etc., and by suggesting that within the limits of a paper of this kind, the subject cannot be exhaustively treated, but only a few salient points can be touched upon. He then continues in the text above and following.

general mode of heating, viz., by steam boilers, no device has yet been discovered that has satisfied all requirements. It is only in the most recent time, in fact, only about a year ago, that a new idea was advanced and experiments were made with several heating plants, which, in my opinion, are calculated to bring about a complete revolution of our system of firing. This is the use of finely distributed coal—what is known as firing with *coal dust*.

From a scientific point of view, it satisfies all the requirements of rational firing. The evils mentioned above, which attach to all grate fires and cannot be avoided, are here entirely abolished. The grate disappears. Coal in a finely pulverized condition is blown into the fire chamber in a thin spray by means of a ventilator, and burns in the same way as gas. Inasmuch as every particle comes into intimate contact with air, it is possible to produce a perfectly smokeless combustion with a very small excess of air. All kinds of coal or brown coal may be used. The poorest is as good as the best—that which cakes as well as that which is dry. Coal screenings, which are almost useless to-day, possess the same value in this method of firing as does lump or nut coal. The sorting of coal is done away with. The easy way of regulating the fire, and the fact that the fire can be momentarily interrupted and started up again as may be required or desired, are advantages which had been confined to gas fuel; but compared with gas fuel, the coal dust has this advantage, that all the heating power of the coal is used, whereas in the production of gas in the generator a considerable amount is lost. The generating arrangement thus becomes unnecessary, and even a smoke stack is not required for dust fuel.

I look upon dust fuel as the fuel of the future. Some of the technical details, it is true, have not yet reached the highest degree of perfection; but this is only a question of time, and probably of a very short time. A principle approved by science is bound to prevail in practical life. For this reason I did not want to neglect to call attention to this subject.

As to the temperature of the gases which escape, it may be remarked that it varies within very wide limits. In the case of steam boilers, direct kettle fires and similar ways of heating, it depends, in the first place, upon the relation of the grate surface to the heating surface of the heating object of the capacity of the latter, as also upon the question whether or not the furnace is forced or not, and to what extent. The fluctuations move between 200° and 400° C. The loss of heat through the smoke stack can be calculated from the amount and temperature of these gases. Between 200° and 400° C. it is as follows:

Where combustion takes place without excess of air	6 to 12
Where the excess is double	14 to 28
Where the excess is treble	20 to 40

per cent of the total reduction of heat. In poorly constructed plants the excess of air often goes beyond these figures, causing a loss by the smoke stack of more than 40 to 50 per cent. It follows that no factory having a large consumption of fuel should fail to control this source of loss, at least at intervals.

The second source of loss of heat, viz., *Imperfect combustion*, is not very great, as a general thing. It is conditioned upon:

(*a*) The escape of combustible gases; (*b*) flying soot; (*c*) loss of coal in the ash pit.

With normal firing only small quantities of combustible gases (CO, CH_4 and H) will escape. The loss of heat caused thereby varies between 0 and 2 per cent. The amount of the volatile soot, also, is always small. Even in the case of fires that smoked badly no greater loss of heat from this source was ever found. As a rule, this loss is much overrated, even by engineers. The reason is, probably, that the smoke is visible to the eye, whereas the greatest source of loss, the excess of air, is invisible. It is easily explained that large amounts of heat cannot be lost by flying soot, considering that nothing is carried away by the current of air except the very finest coal dust and the fine flakes of carbon produced by the dissociation of certain hydrocarbons, more particularly æthelen. Moreover, it should be considered that the formation of smoke is periodical only. In the ordinary grate firing it begins when fresh coal is thrown in, and it continues only for a few minutes. The time when combustion is smokeless invariably lasts much longer than the period of smoking. The principal loss in our method of firing, therefore, is to be sought, not in the visible smoke but in the invisible excess of air.

Of considerably greater extent, at times, is the loss of coal in the ash pit, more particularly where screenings are used, or where the coal forms "clinkers." This formation of clinkers, which is frequent in coal, is caused by the composition of the organic matter in the coal or in the composition of the ashes. There are three principal kinds of coal—some will cake, some are dry like sand, and others between the two extremes. Coal cakes by melting in the heat and forming hard lumps or cakes, which stop up the grate and keep out the draft. The sandy coal, on the other hand, will not melt even in the greatest heat. These properties are based upon the composition of the organic substance in the coal. Caking coal generally contains more hydrogen than that which does not cake.

Whether the ashes of coal will melt depends upon the ratio of the silicic acid to the other mineral substances, more particularly to the oxide of iron, lime, etc. If the ashes melt, it will cause great difficulties in firing, the clinkers stop up the grate and inclose particles of coal, keeping them from being burnt. These clinkers sometimes contain as much as 40 to 60 per cent of coal.

As regards the last source of loss, *the direct loss of heat to other bodies*, it does not vary very much. In the case of boilers with jackets, the loss by radiation, on an average, amounts to 3 to 6 per cent of the entire heat produced. We have to-day the results of complete heating tests for about 1,000 steam boilers, which were made in accordance with my directions by inspectiors of the Austrian Steam Boiler Co., the result being that the use obtained from coal has, in the case of many plants, been increased by 10 to 30 per cent. . . . . .

——The directors of the old Oakland Ice Co., Gardiner, Me., held their last meeting August 29, declared their last dividend and closed up the affairs of the company. The company was organized in 1873, and sold its buildings in 1890. The present directors were S. N. Maxcy, D. C. Shepard, A. Davenport, Gardiner; S. C. and E. W. Whitehouse, Augusta. Three hundred shares were held, and $16.46 per share was the final dividend, which was paid.

[*Reprinted from* ADVANCE SHEETS.]

ANHYD. AMMONIA GAS AS A MOTIVE POWER.*

WHAT FORCE SHALL SUCCEED STEAM AS A MOTIVE POWER—ANHYDROUS AMMONIA GAS A STRONG COMPETITOR—AMMONIA GAS MOTORS, ETC.

BY T. WALN-MORGAN DRAPER.

THE burning question of the hour now is: "What power shall supplement or succeed steam and other forces hitherto used by mankind, yet now found inadequate to meet the growing developments of science and civilization?" This question, like Banquo's ghost, will not down, nor has the very useful broad utility of electricity settled the problem in a satisfactory manner, principally on account of its cost. Many bright people are endeavoring to discover a force which shall fulfill the conditions of tractability, safety and economy, as yet without success.

In some experiments upon ammonia as a motor fluid recently conducted by myself, under the inventions of others, and by subsequent close study and investigation, I believe that the conditions above referred to have been more nearly fulfilled than in any other process heretofore proposed for its use.

At the present time, nearly all the sal-ammoniac and other ammoniacal salts are prepared from the liquor which is obtained as a by-product in the manufacture of coal gas. Coal consists of the remains of an ancient vegetable world, and contains about 2 per cent of nitrogen, the greater part of which, in the process of the dry distillation of the coal carried on in the manufacture of gas, is obtained in the form of ammonia dissolved in the water and other products formed at the same time.

Recently W. F. Donkin has proved that ammonia can be synthetically prepared by the direct combination of its elements, the silent electric discharge being, for this purpose, passed through a mixture of nitrogen and hydrogen. It is also formed by the putrefaction or decay of the nitrogenous constituents of planets and animals; by the dry distillation of the same bodies; by heating these substances strongly, out of contact with the air; by the action of hydrogen on the salts of nitric or nitrous salts.

Ammonia gas has a density of .596 (air being 1.0); its volume is 983 times greater than the space occupied by its liquor, while steam under identical pressure occupies a space only 303 times greater than water. The latent heat of ammonia is about 752°, that of water being 990°. Ammoniacal gas is absorbed with avidity by water, one volume water at 80° F. absorbing about 700 volumes of gas. The water becomes specifically lighter, while its volume is being augmented one-third. As the absorption of the gas goes on, the water becomes heated, and the latent heat of the gas reappears as sensible heat. It is in this property that water possesses of absorbing such volumes of gas and of becoming heated while doing so, that the practicability of using this gas as a motive power rests; always bearing in mind that heat is the prime agency for producing gas. Ammoniacal gas can be liquefied by pressure and frozen by a mixture of solid carbonic acid and ether in a vacuum. Its density is only about half that of atmospheric air. It is a strong base, and forms a great number of salts which are isomorphous with those of potassium and exhibit a close analogy to them. One of the most important of these salts is sal-ammoniac, NH_4Cl, largely used in dyeing, soldering and tinning. At present ammonium sulphate $(NH_4)_2SO_4$ is the starting point for the manufacture of ammonium salts. It is used extensively as a fertilizer. The commercial article, sal-volatile, is a mixture of hydrogen ammonium carbonate and ammonia carbonate. An ammoniacal salt is one formed by the union of ammonia with an acid, without the elimination of hydrogen, differing in this from metallic salts, which are formed by the substitution of the metal for the hydrogen of the acid.

Aqueous ammonia, solution of ammonia, spirits of hartshorn, or the combinations of ammonia with water, must also necessarily be understood for a full comprehension of our subject. Both water and ice absorb ammonia with great avidity, with considerable evolution of heat, and with great expansion. Davy found that one volume of water at a temperature of 10° C. and 29.8 inches barometric pressure absorbs 670 volumes of ammonia, or nearly half its weight; the specific gravity of this solution is 0.875. Aqueous ammonia is a colorless transparent liquid, smelling of ammonia, and having a sharp, burning, urinous taste. Its specific gravity varies from 1.0 to 0.85, according to the amount of ammonia contained. Its boiling point varies according to the percentage of ammonia and its specific weight. At a specific gravity of 0.85 and 35.3 per cent ammonia, its boiling point is — 4° to +92° when its specific gravity is 0.99, and its percentage of ammonia is 2.0. A perfectly saturated solution freezes between — 38° and — 40° C., forming shining flexible needles. At —49°C. it solidifies to a gray gelatinous mass, almost odorless. It loses almost all its ammonia at a temperature below 100° C. Aqueous ammonia possesses the property of dissolving many salts which are not soluble in water, chromic and stannic oxides, the protoxides of tin, cadmium and zinc, the oxides of copper and silver; these combinations are decomposed by heat, losing ammonia.

In order to determine the percentage of ammonia in any given solution of what is commonly known as "commercial ammonia," I have found the following table of great value and practically correct; it rests on the temperature of the solution:

Deg. Beaume.		Per cent ammonia.	Deg. Beaume.		Per cent ammonia.
1/16	=	0.117	17	=	13.12
1/8		0.234	18		15.0
1/4		0.468	19		16.87
1/2		0.931	20		18.75
11		1.87	21		20.62
12		3.75	22		22.5
13		5.62	23		24.37
14		7.5	24		26.25
15		9.37	25		28 12
16		11.25	26		30.00

The initial temperature of steam at 150 pounds pressure is 446° F. Anhydrous ammonia gas at the same pressure has a temperature of 80°.

The relative proportions of the two are :

Water.	Ammonia.
Latent heat, 990	752
Relative volume, 1,728	.1313.28
Boiling point, 212° F.	—38.5° F.
Ratio, 100	.76

The temperature and pressure exerted by ammonia gas are founded on the relative points as ascertained in practice; that at a temperature of 60° F., there is exerted a pressure of 110 pounds, and at 80° F., a

* Presented at the Chicago meeting (August, 1893) of the American Society of Mechanical Engineers, and forming part of volume XIV, of the *Transactions*. The author is a member of the Society; residence, New York city.

pressure of 10 atmospheres, or 147 pounds, the proportion being 20:37 : : 1° : x.

The following pressure table is made up from actual practice, and may be regarded as substantially correct:

A temperature of		exerts a pressure		A temperature of		exerts a pressure	
50°	Fahrenheit	92.5	pounds	71°	Fahrenheit	131.35	pounds
51°	"	94.35	"	72°	"	133.2	"
52°	"	96.2	"	73	"	135.05	"
53°	"	98.05	"	74°	"	136.9	"
54°	"	99.9	"	75°	"	138.75	"
55°	"	101.75	"	76	"	140.6	"
56°	"	103.6	"	77	"	142.45	"
57	"	105.45	"	78°	"	144.3	"
58°	"	107.3	"	79°	"	146.15	"
59°	"	109.15	"	80°	"	147.0	"
60	"	110.0	"	81°	"	149.85	"
61°	"	112.85	"	82	"	151.7	"
62	"	114.7	"	83°	"	153.55	"
63°	"	116.55	"	84°	"	156.4	"
64°	"	118.4	"	85°	"	157.25	"
65°	"	120.25	"	86	"	159.1	"
66°	"	122.1	"	87°	"	160.95	"
67	"	123.95	"	88°	"	162.8	"
68°	"	125.8	"	89°	"	164.65	"
69°	"	127.65	"	90	"	166.5	"
70°	"	129.5	"				

If smaller or greater pressures are required than those given in the table, it becomes simply a question of lowering or raising the temperature.

Anhydrous ammonia, or *dry ammonia* gas, condenses to a liquid at —38½° F, or it can be condensed by a pressure varying from 150 to 185 pounds at a temperature of +70° F. On the removal of this pressure, the gas expands fully. This is not entirely availed of in the ammonia motor, as during its expansion it is used like steam to drive the piston of an engine. The gas is as easily handled as steam, quite as safe, far cheaper, and in many respects resembles steam.

There have been a great number of engines invented and patented, using ammonia gas alone, or in combination with other vapors as a motive force. Such motors have been invented by Gamjee, Seyforth, Jean Foot, Lamback, Dr. Emile Lamm and many others, who, with two or three exceptions, have gone about the work in hand as patenters and copyists, and not as true inventors. At any rate, the patent offices are full of their claims. Enough has been accomplished, however, to demonstrate that the ammonia engine is a practical success, and no longer a theory and an experiment; and, further, that ammonia gas alone, and not combined with other vapors, is the true solution of this subject. Such motors have been run under the most severe conditions, and have proved an unqualified success in every way; and were it not for the greed and unscrupulous tactics of certain people, there would be several lines of ammonia cars and locomotives in operation.

The ammonia locomotive is not perfect to-day, nor is our older friend, propelled by steam, but it will be very soon.

I wish, before describing the newest motors and plants, to draw attention to the older machines.

M. Fromont's ammoniacal engine was exhibited at the Paris Exposition of 1868. His motive power was a vapor containing 80 per cent ammonia and 20 per cent steam, which latter was, as you will learn later, directly contrary to the present method, where the endeavor is to obtain as dry a gas as possible, and thereby a perfectly pure anhydrous ammonia liquid. Fromont's engine, however, demonstrated one thing, viz., its economy, as it consumed only one-quarter as much fuel as a steam engine of like power and under the same conditions.

Gamjee's engine, called the "Zeromoter," was intended to use ammonia gas as the power agent. It was a thermodynamic engine, and one with a closed circuit, with a liquid boiling at a low temperature, relatively to water transformed into vapor, the molecular energy of which is converted into the mass or molar motion of the piston, so that its initial condition is restored. In this manner, in a heat engine, the temperature is extended within which the heat is utilized downward, in the direction of the absolute zero, instead of upward, above the temperature of surrounding objects.

The first law of thermodynamics is: "Heat and mechanical energy are mutually convertible in a certain ratio"

The second law: "It is impossible for a self-acting engine, by means of inanimate material agency, to derive mechanical effect from any portion of matter by cooling it below the temperature of the coldest of surrounding objects."

Clausius, who first clearly defined Carnot's principle, says: "It is impossible for a self-acting engine, unaided by any external agency, to convert heat from one body to another body at a higher temperature.

"I refer to these thermodynamic laws here, as they bear directly on the principles of the ammonia engine as now worked out. The invariable principle, that the same cause (under the same circumstances) produces the same result, is applicable to both steam and ammonia (the law of Mariotte), which is invariably the same, viz.: That all gases or vapors expand equally by the same degree of heat added to their specific heat." However, ammonia is slightly an exception to this, and greatly in its favor.

Gamjee made the following statements: "Anhydrous ammonia at 0° C. has a vapor tension of 3,183.34 mm., or about four atmospheres. At 10° it reaches 4,574.03 mm., or six atmospheres. At 20° the pressure is 6,387.78 mm., or nine atmospheres. At 30° (tropical heat) it is over 8,000, or 10½ atmospheres. Since at blood heat 200 pounds to the square inch is available, it is evident that the usual temperature of ocean or river water is most desirable in practice, and best when below 20° C. The latent heat of ammonia is used in developing energy so as to reduce the amount of rejected heat to a minimum, and to obtain a maximum of liquefaction." Gamjee's engine was a double cylinder rotary engine.

It is the remarkable affinity of ammoniacal gas for water, by which it is able, at any time after its condensation into a liquid, to reproduce, at a distance from where it was condensed, a force equal to the heat which was necessary for its condensation, which makes the ammonia gas engine a possibility.

The most important of the older engines was that of Dr. Emile Lamm, later ones, in their principles, following his closely. In 1870, in describing his engine, he said: "This reproduction is owing to the fact that the latent heat of the gas appears anew in water of reabsorption, and is retransferred to the liquefied gas. This takes place through metallic tubes of which the reservoir is composed, from the water of reabsorption which surrounds them, and is similar in its operation to the action of fire in the furnace of a steam boiler."

Lately we have vastly increased the number and dimensions of these tubes over those thought sufficient by Dr. Lamm, because, although we find that a small

evaporation surface would demonstrate the utility, yet for practicable purposes a large evaporating or heating surface was necessary. At a single step I increased this surface for 1 H. P. from five to thirty square feet, and find it economical in many ways.

By reference to Fig. 1, which is Dr. Lamm's engine, the arrangement just spoken of will be easily understood; *c c* is the ammonia reservoir filled with the anhydrous liquid to the line *d d*; *A A* is the tank filled with weak ammoniacal water to the line *aa*; *C* is the pressure pipe leading to the engine *E E*; *D* is the exhaust pipe leading from the engine to the water in the bottom of the tank *A A*. When, by means of the throttle valve *x*, the gas in the reservoir *B* is permitted to act on the piston of the engine, through the pressure pipe *C*, the engine begins to work with a force equal to 150 pounds to the square inch, at a temperature of 90° F., consequently the whole apparatus must remain at a temperature of 90° F. to give an effective pressure of ten atmospheres for any given time that may be desired.

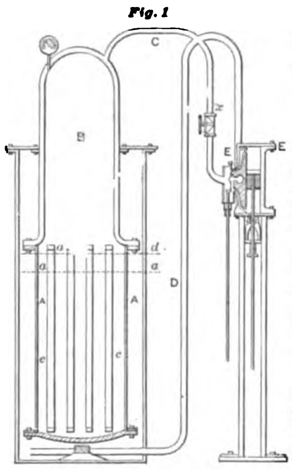
One of Dr. Lamm's engines, propelling a street car on a seven-mile run, was equal to 2 H. P.; the liquid ammonia expended was 1.16 cubic feet. Therefore, the latent heat of ammonia gas (according to Dr. Lamm) being 880, the whole heat expended during the trip made was sufficient to raise eighty-four gallons of water from a temperature of 83° to the boiling point, 212°.

I will now proceed to discuss and describe the ammonia manufacturing plant and the ammonia engines as they are now, in the light of the latest improvements.

The chief difficulty with all plants for the manufacture of anhydrous ammonia liquid has heretofore been that the gas which it has been sought to condense contained more or less aqueous vapor, which, remaining with and being condensed with the gas, resulted in a liquid not absolutely pure, and robbed it of its power to some extent.

In Fig. 2 is shown a design, an improvement on one actually in operation, which meets this difficulty in a most satisfactory way. I will say in advance of describing the plant, that it is absolutely necessary that all parts of such a plant shall be so constructed as to withstand in *all its parts* a pressure of at least 200 pounds to the square inch.

Fig. 1



DR. LAMM'S AMMONIA ENGINE

A is a solution boiler, or still, similar in construction to an ordinary tubular boiler, so set that the end next the stack *s* is slightly lower than the other. The grate is at *G*, and the heat passes first beneath the boiler, thence back through the tubes, and out at the stack. No great heat is required, 122° F. sufficing. The ordinary commercial ammonia is introduced at *c*, and falls on the scattering plate *p*, and from thence on the tubes *kk*. You will observe a number of upright partitions *aaa*, and you will also notice that the first one is raised just above the bottom of the boiler, the next one being all the way down, the next above, and so on. These partitions are merely thin sheets of boiler iron, through which the tubes pass, their object being, in connection with the sloping setting of the boiler, to force the ammonia solution to follow the course indicated by the arrows, in order that it may, by means of the heat, become thoroughly deammoniaized. This latter operation begins immediately when the solution commences to fall on the tubes through the scattering plate, and it is so thoroughly effected that by the time it reaches the blow-off point at *x*, it contains usually not over 5 per cent ammonia. The gas, as it evaporates, rises from the boiler, through the scattering plate and the inpouring solution, to and through *b*, into what is called a dehydrator *D*. The gas is accompanied by aqueous vapor, and the object of the dehydrator is to free it from this. The dehydrator is a long cylinder, having at either

PLANT FOR MANUFACTURING ANHYDROUS AMMONIA.

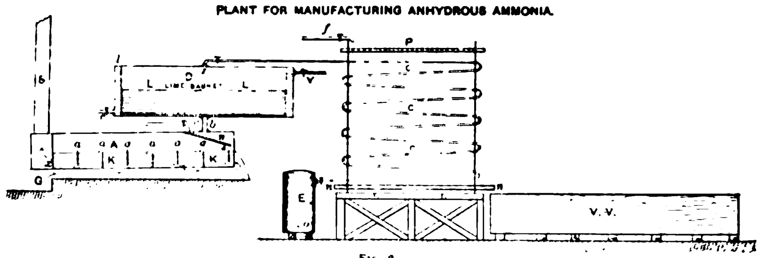


FIG. 2

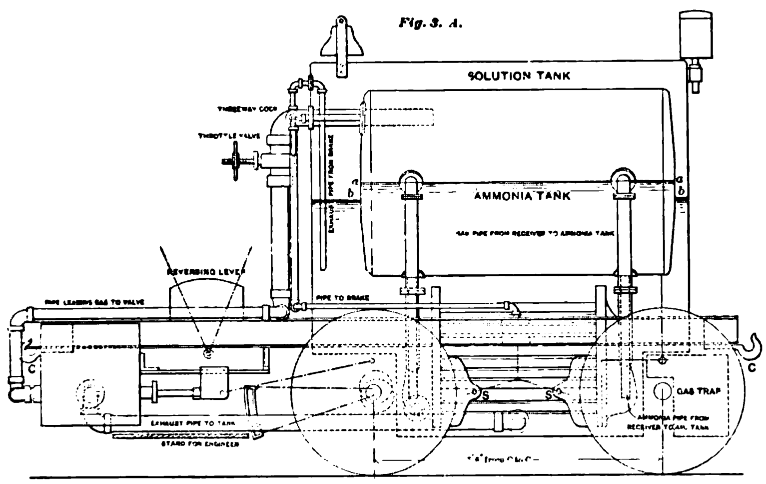
end a water compartment *l l* connected with a series of tubes. On the bottom of the cylinder is an angle-shaped perforated plate; the gas rising from the boiler meets this perforated plate, which scatters it all along and around the tubes, through which cool water, let in at *Y*, and passing off at *E*, is constantly flowing. Just above the tubes is a wire basket *Z Z*, filled with lime, the pieces being about the size of peas; the partially dehydrated gas, from contact with the cool tubes, now passes through the bed of lime, which is about two inches thick, and is there freed of its watery vapors, and becomes fully dry. By this means one obtains in the upper, or storage, part of the dehydrator, a perfectly dry gas, which, passing out of the top at *Z*, flows to the coils *c c c*, where it is condensed, and falls by means of gravity and the pressure from the still (150 pounds) behind it into the storage tank *E*. There are ten rows of condensing coils, only one of which is shown in the figure; each row has a total length of 100 feet. The condensation is accomplished by means of very cold water falling from the scattering table *P* over the coils. In order that this water may not be wasted, it is caught in a tray *n n* below, and conducted to a series of wooden vats *V V*, where it is allowed to cool, and used over and over again; it can also be artificially cooled in the same manner as is done in the cold storage plants.

The illustrations shown as Fig. 3 are of an ammonia locomotive recently designed for transfer purposes, intended to be used on a cable road for shifting the cars on and off the cable, into or out of the car shed. The house space of the company being limited, their engineers arranged an electric traveling table, and on this a turntable; the latter was, of course, quite limited in length, only long enough to allow of a 36-foot car and a motor ten feet over all. In addition to this, the company's engineer imposed, on account of balance of the table, that the total weight, with charge, of the motor, should not exceed three tons, and at the same time should have a traction force of 1,000 pounds; total height above rail, ten feet; speed, not less than six miles per hour, and this speed to be attained in six seconds. Further, the shifter must be able to run a reasonable length of time without recharging. The annexed draw-

ings illustrate the design made to fill these specifications. I have made some slight changes from the original designs, notably in placing the gas trap forward of the front axle, instead of just behind the rear axle, and have obtained thereby a more perfect distribution of weight. I have also largely increased the amount of evaporating surface, by doubling the number of the tubes, adding thereby to the quickness of evaporation and the pressure. Its power is vastly increased, as is its speed, by these changes, without overstepping the limits of weight, etc., imposed.

The locomotive shifter is direct acting. I have endeavored in the drawings to make everything so plain that description would be largely avoided. The inner or anhydrous ammonia liquid tank, of ⅜-inch boiler iron, is to contain the charge, in this case calculated amply for a 14-mile run. This charge fills the tank half full, the upper half serving as a gas reservoir. Below this tank is hung the evaporator, manifolded at either end. The evaporator and the ammonia tank are enclosed in one large outer, or solution, tank, which is partially filled with water, or the blow-off solution from the still (containing about 5 per cent ammonia) to the line *b b*. The engine cylinders are placed on the frame

Fig. 3. A.

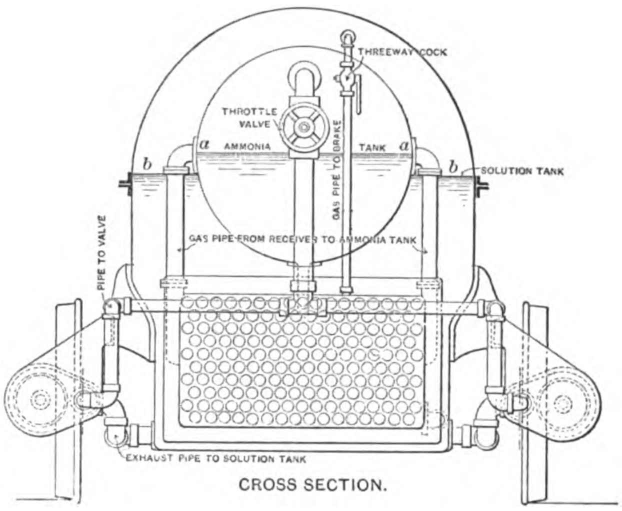


SIDE ELEVATION

at the rear end of the locomotive. The outer tank is made in three sections (no great pressure is possible in it) on account of cheapness of construction, and it also allows of the raising off of the upper rounded section, or the intermediate, to examine or repair the inner tank, evaporator or piping. The frame consists of two 4-inch channel irons (twenty pounds per yard) nine feet long, which support the outer tank by means of cast iron suspenders bolted to the frame, the jaws for the axle journal and the cylinders are also bolted to the frame. It is supported by equalizers connected by means of springs. The frame is twenty inches above the rail, with its full load.

The machinery consists of two 6×9-inch cylinders, with piston valves, surrounded by cast iron jackets, the initial power behind the piston being 4,240 pounds. The piston works on a cross-head which is connected with the connecting rod to the driving wheel, and thence by means of a link rod to the front wheel. The piston valves are inside, and their rods are connected by means of rockshafts and levers with the reversing link, which latter are also inside. The brakes, worked by gas also, led through a three-way cock or brake valve, to a 3-inch cylinder, the piston of which works on the brake arms, and these on the shoes. When the gas is on, and it is desired to cut off the brakes, the gas returns through the valve to the solution tank, where it is at once absorbed. The brake shoes are hung in such a

Fig. 3. B.

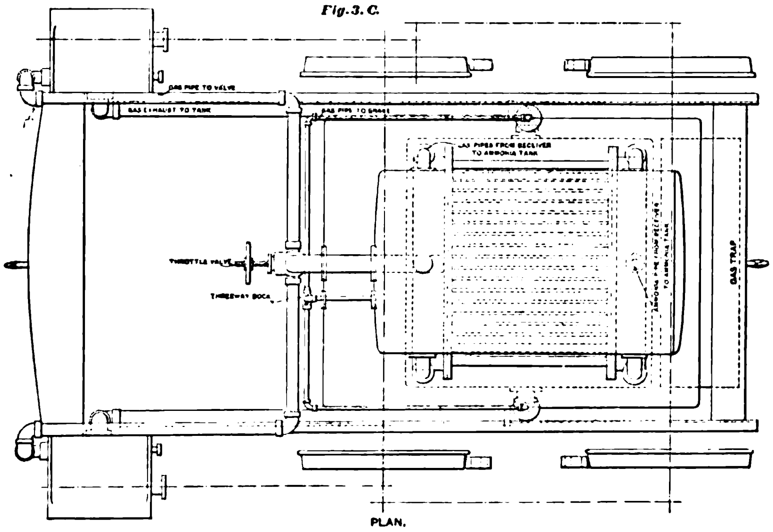


CROSS SECTION.

manner that they loosen when the gas is cut off. The gas trap is hung in front of the forward axle, is of ⅛-inch boiler iron, air and water tight.

The manner of operating the locomotive is as follows: The inner tank receives its charge, and the outer tank at the same time is filled with the 5-7 per cent blow-off solution from the still, this solution being charged usually at a temperature of 80° F., though a little more or less temperature does not matter; if above 80° it will give increased pressure; if below, it will increase its heat in running by the discharge from the cylinders. The motor is now ready to run; when its charges are exhausted, it returns to the station and they are renewed. The quantity of absorbing fluid in proportion to the anhydrous liquid charge is about five to one. When the liquid has been exhausted, it has been in the form of exhaust gas absorbed into the solution in the outer tank, which latter has practically become commercial ammonia, which, being withdrawn at the station, is redistilled and used over and over again, a new charge taking its place in the motor, as well as a new charge of anhydrous liquid. Thus the process repeats itself almost indefinitely, the annual loss being not over 10 per cent; from commercial ammonia to anhydrous ammonia gas, to anhydrous liquid, to gas, in

Fig. 3. C.

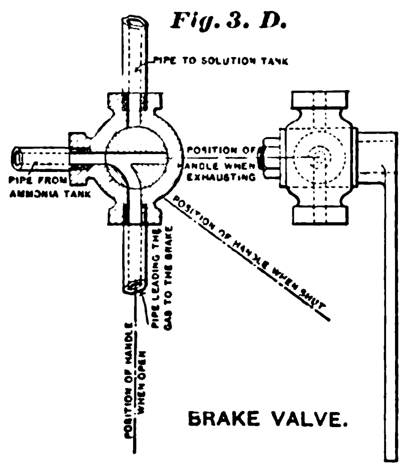


PLAN.

this form used as a motive power, discharged then into water, which it converts into commercial ammonia. There is no reason why pure water should not be used,

instead of the weak solution of ammonia from the blow-off, for absorbing; this is, in fact, done, but the objects in using the blow-off solution from the still are obvious: First, the small percentage of ammonia therein is saved; and, secondly, the temperature necessary for charging for proper operation could not be more economically or easily obtained.

Fig. 3. D.



BRAKE VALVE.

The economy of such a motor is easily understood: Practically no loss of material, small amount of fuel consumed in the manufacture, the absence of a stoker on the motor, it requiring but one man to run it.

The exact cost of manufacturing anhydrous ammonia liquid has not yet been ascertained, nor the cost of operating; this will only come with time and experiment; but sufficient is known to state positively that the cost is not over one-fourth that of steam or any other motive force.

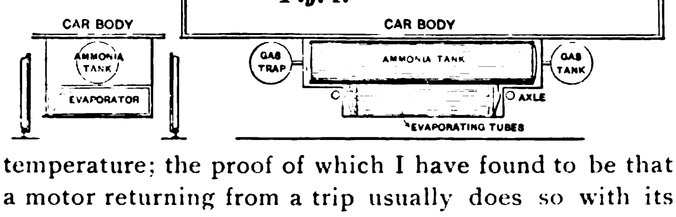
To revert again to the locomotive, the liquid force is as follows: It passes down from the inner tank into the evaporating tubes, and these, surrounded by the 80° F. solution, cause it to rapidly evaporate at a pressure of 147 pounds to the square inch. It rises from the manifolds at the ends of the tubes to the upper half of the inner tank, from whence it flows to operate the engines. The gas exhausted from the engine cylinders passes in at the bottom of the outer tank, at a point between the axles, and is instantly absorbed. A small pipe, leading from the gas reservoir, passes through the three-way cock to the brake cylinder, and by simple means is returned into the solution of the outer tank.

The engine cylinders are surrounded by jackets, through which absorbing solution flows, for a two-fold reason; namely, to keep up an equitable expansion temperature, and to absorb any gas leakage that should occur.

The object attained by the gas trap, which is about half full of water, which it is seldom necessary to renew, is to absorb through a check valve, by which it is connected with the outer tank, any gas not absorbed therein, avoiding thereby any possible back pressure, smell or leakage.

The discharge of the exhaust gas into the solution of the outer tank keeps the temperature of this solution almost constantly at 80° F., for reasons already given, the exception being that this discharge usually raises the

Fig. 4.



temperature; the proof of which I have found to be that a motor returning from a trip usually does so with its gauge showing a higher pressure than that with which it started out. Against this I find that if from any cause an ammonia motor is allowed to stand, say on a siding all night, the temperature of the absorbing solution will fall materially. A simple means of raising its temperature, and the pressure as well, is to allow a small jet of ammonia gas from the reservoir to flow into the absorbing solution, which quickly heats it.

Fig. 4 represents a recent plan of mine for placing the motor and machinery beneath the platform of an ordinary street car. Similar, but very cumbersome, apparatus has already been placed in this way, and it had various inconveniences which this arrangement obviates. This motor, which could be attached to any car without altering its body, has the following characteristics:

Capacity of solution tank	600 gallons
Capacity of ammonia tank	90 gallons
Heating surface of tubes	200 square feet
Capacity of gas tank	40 gallons
Capacity of gas trap	40 gallons
Center to center of axles	6 feet

Solution tank is 8 feet by 2 feet 6 inches by 3 feet 6 inches.
Ammonia tank is 7 feet 6 inches by 17 inches.
Diameter of wheels, 30 inches.
Bottom of tank above the rail, 6 inches.
Car body, 16 feet without platforms.

The cost of such a motor placed beneath ordinary street cars would be in the neighborhood of $600.

COLD AND LENGTH OF DAYS.

COLD climates are always productive of a vigorous animal existence, says an unidentified writer. "I know this to be a fact from recent studies that I have made of various climatic conditions and their effect. Now I have found that the life of people living in a tropical climate is comparatively short. Not only their physical life but their life as a nation is affected by this curious law. In evidence of this latter assertion I can point to all the short-lived governments that have arisen and fallen in the heated zones of this new continent. Everybody is aware of the constant revolutions and uprisings in Mexico, Central America and the South American republics; whereas North America, throughout the temperate regions, has remained for 100 years but little disturbed.

"Africa is a constant battleground for the blacks, and southern Asia and southern Europe have ever been the scene of internecine conflicts. On the other hand, Russia has remained undisturbed for centuries, the people being apparently calmed by the cool climate conditions.

"So, too, with Sweden and Norway, Denmark and the North German provinces. There nations as individuals are phlegmatic. They are not easily moved to resentment except where the burdens imposed are of the most tyrannical nature. So it happens that the governments have lived on for centuries, their kings tracing their ancestry back through the ages until they lose their record in the barbaric period of the Roman domination. The Scandinavians (which term comprises as a type name most of the inhabitants of north Europe) are long-lived, many of them reaching the extreme old age of 115 years.

"The Scandinavian records are full of the names of men who lived to exceeding old age, while the remarkable names of the southern nations are always coupled with the statement of an early death."

THE ice crops of America, Norway, Sweden, Russia and Belgium and other countries have a total output of about 15,000,000 tons, and an aggregate value of nearly £3,000,000.

[*Abstracted for* ICE AND REFRIGERATION.]

LEGAL MATTERS.

RELATIVE RIGHTS OF OWNERS OF PONDAGE AND SOIL TO ICE FOUND ON PONDS—THE QUESTION OF LIABILITY—MINOR LEGAL NOTES.

WHEN one has acquired the right to flow the lands of another for mill purposes only, the latter has not the right, as matter of law, to take and use for mercantile purposes the ice formed upon the pond over his land; but when such removal will cause a material injury to the pond owner in his use of the water for his mill, it may not be removed. Whether it will so injure him depends upon the facts and circumstances of each particular case, and the question must be determined by the trial. So holds the Supreme Court of Errors of Connecticut, in the case of *Howe* v. *Andrews*.

Here the owner of a grist mill and saw mill, to supply water for operating which, maintained a dam upon lands owned by another person, and thereby set back the water of a small stream, creating a shallow pond, which covered about three and a half acres of land. The owner of the land took and carried away for mercantile purposes ice formed upon the pond, and to facilitate such taking and removal, drove teams over the earthwork of the dam, and set wooden posts therein. Upon the trial by jury, the latter's title to any of the land flowed was disputed by the owner of the mill, and the miller's right to use the ponded water for the purposes of the saw mill was denied by the person claiming to be owner of the land; but for the purposes of the trial it was assumed that the owner of the mill had the right to maintain the dam and use the water of the pond for both of the mills,and that the other party had the title to the land flowed. Each party upon the trial claimed the absolute ownership of the ice formed upon the pond; the one as incident to the right of pondage, the other as incident to his right to the soil.

Every owner of land through which a stream of water runs has ordinarily, says the court, a right to the use of the water of the stream as it is wont to run. This right may, however, be parted with. A lower proprietor may by purchase, adverse user, or by proceedings under the flowage act, acquire the right to dam the stream, and set back the water upon the land of the proprietor above, and to use the water thus ponded in various ways and for various purposes. Unless the upper proprietor has parted with or lost his right to so use the water of the stream, he may doubtless use it for domestic purposes, and for watering his stock and irrigating his land, although it has been thus ponded. He may make any use of it not inconsistent with the original or acquired rights of the owner below—any use which works no actual and perceptible injury to his rights. In this case, the owner of the pondage right was not the absolute owner of the ice formed upon the pond, but had the right to have the ice remain upon the pond so long as and whenever such continuance would be useful to him in the legitimate exercise of his right to use the water as motive power for his mills; and, subject to this right, and only subject to it, the owner of the soil might make such use of the ice as did not interfere with or injure the owner of the pondage in his rights. The latter had the right to pond the water for mill purposes, he had the right to have the ice remain upon the pond so long as and whenever its continuance would be useful to him in the operation of his mills, and the owner of the soil, in his use of the water, was subject to this right of the owner of the mills.

MINOR LEGAL NOTES.

——The St. Paul Lake Ice Co., St. Paul, Minn., September 13 filed a separate complaint in the case of Mary Morse against the St. Paul Ice Co. and others. Judgment is asked for the sum of $2,624.94. The court is asked to require an accounting of the St. Paul Ice Co., and to sequester the stock to require the stockholders to pay the claim.

——The Miami Ice Co., Hamilton, Ohio, and the Ohio state board of public works have compromised their differences. The ice company recently refused to pay the toll on ice over the canal, and built an ice run which was torn down by the state, represented by Collector Craig. The ice company paid $472.12 in tolls and has rebuilt the ice run.

——The stockholders of the Cottage Grove Ice Co., Cleveland, at a recent meeting took initial steps toward straightening out the company's finances, deciding, in order to resume, to make all the holders pay their proportionate share of the company's indebtedness after the entire amount of assets has first been disposed of. An agreement to this effect was drawn up and signed by all of the stockholders present, each paying an initiation fee of $2 as evidence of good faith. The liabilities are $38,860.75. The company in 1890 lost $26,500; in 1891 made a dividend of 9.6 per cent, and in 1892, 9.1 per cent.

——On August 31, N. R. Steiner, A. M. Cole and C.W. Seiberling began suit at Akron, Ohio, against Frederick Raulfs, William Klages, Emma Raulfs, Mary L. Klages and Fairbanks, Morse & Co., asking judgment for $1,950. Messrs. Raulfs and Klages were induced to go into the ice business on representation by a Mrs. Spreng that she would be able to afford them elaborate financial assistance. The above suit is the result of their decision to go into the business. They bought land of the plaintiff, and when Mrs. Spreng disappeared they were unable to make payments on the land. The plaintiffs ask for foreclosure of mortgage, sale of property, and for an execution against the defendants for the balance.

——The Corryville Artificial Ice Co., Cincinnati, undertook during the year 1892, to fund its floating debt by placing an issue of $30,000 mortgage bonds. One of the trust companies was made trustee, and the bonds were placed upon the market, but they did not sell. The creditors became clamorous, and in January last, at a meeting of the stockholders it was decided to assess all the stock 15 per cent, and with the proceeds take up the floating debt. Joseph Boehm, holding 333 shares of the stock, was liable to an assessment of $3,995. He paid $1,500 thereon, but has failed to pay anything further, and September 17 the company brought suit through Louis J. Dolle, for recovery of the balance. Henry Boehm, a holder of nine shares of the company's stock, has failed to pay any part of his assessment, and was sued for $135.

——The state of Ohio's canal board and the Cincinnati Ice Co. have been at outs. on account of the ice company having had, it is claimed, its ice ponds at Ross and Chester lakes flooded free of cost since 1877. James Cullen, president of the company, was before the board and claimed to have a contract with the state, but the board has not been able to find any record of it. It has been the custom of the board, where ice companies shipped their product by canal, not to make any charge for flooding ponds, although the law says $25 per acre shall be charged. The Cincinnati Ice Co. has been shipping ice by rail while the state flooded its ponds free. The board now proposes to make the company pay tolls on ice shipped by rail, and is also considering the matter of charging it the legal rate for flooding its ponds. The company claims it is entitled to free water, as it has largely assisted in keeping the canal free from pollution. The attorney general will be asked for an opinion before any action is taken.

——The Diamond Ice Co., Paterson, N. J., which is composed of 250 local business men, principally grocers and butchers, has gone into the hands of a receiver. The panicky times and consequent inability to make collections, and the tardiness of a number of the stockholders in paying their subscriptions are the chief causes of the collapse of the company, which was thought to be doing a thriving business all summer. Last spring the company erected a building on Straight street and stocked it with machinery for making artificial ice. The patronage expected from shareholders alone, it was thought, would be sufficient to meet all current expenses and gradually pay off the debts. Patrons were allowed to run bills too long, and when the dull times began to affect the tradesmen they found themselves unable to meet their obligations. The nominal assets are $125,000, with liabilities of 75,000; unpaid subscriptions, $7,000. On September 15 John S. Barkalow was appointed receiver. It is believed the company will be reorganized and the business continued.

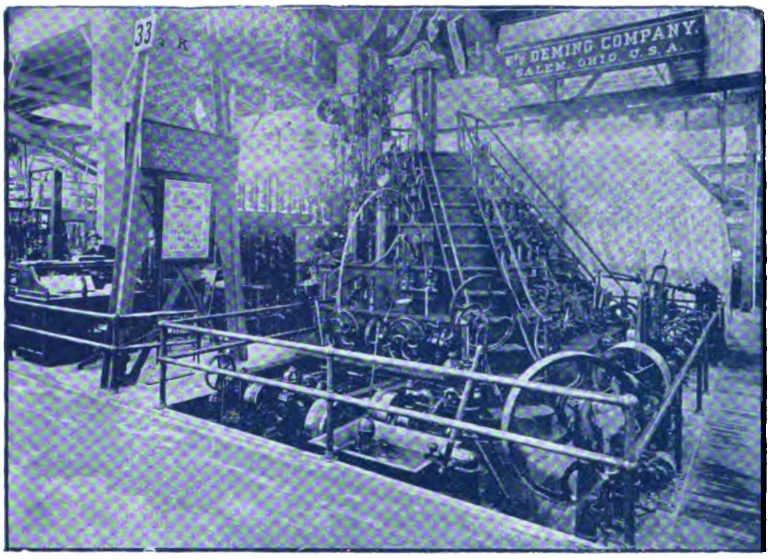
THE DEMING CO.

The main exhibit of the Deming Co., manufacturers of pumps and well supplies, Salem, Ohio, at the World's Fair, is located in Machinery building, on the north side of the pumping basin, Col. K, 33. Another exhibit is found in Horticultural hall, Col. U, 74. The Machinery hall exhibit, however, is the more extensive and important to readers of this journal, in that it consists of their display of pumps, rotary, single and double-acting, hydraulic rams, etc. The position of the exhibit being a conspicuous one, on a main thoroughfare of the Annex, the company has made their space very attractive, as may be inferred from the accompanying picture. One effective feature is the exhibit of pumps with glass cylinders to show the valve action. Among the specialties to be seen in operation is a special hydraulic ram for elevating water, by hydraulic pressure, to upper floors and tanks. Other forms of rams are also shown. The pyramid of the picture is built entirely of pumps, at the top of all being a tank into which the streams of water fall that are thrown from the pumps below. Another special feature is the "Little Giant" hydraulic pressure test pump, for testing pressure strength of boilers, pipes, cylinders, etc., up to 800 lbs., the working parts of which are bronze. Wm. L. Deming, author of the catalogue noted elsewhere, and general manager of the company, is in charge of the exhibit at the Fair, and will be pleased to meet the reader there during October.

NEW BOOKS.

SPECIELLE METHODEN DER ANALYSE. Von G. Kruess. Hamburg und Leipzig; Leopold Voss. 1893. 8vo, paper; pp. 96; price, 3.50 marks.

This is the second and thoroughly revised edition of this work which illustrates the application of physical methods of measurements to the solution of problems of a rather chemical nature, and deals more especially with the determination of specific weight, molecular weights and specific heat, with spectrum analysis and the calorimetric and polarization methods of analysis. The modern appliances for this purpose are fully illustrated by cuts and diagrams



WORLD'S FAIR—EXHIBIT OF THE DEMING CO., SALEM, OHIO.

THE ELECTRIC TRANSMISSION OF INTELLIGENCE AND OTHER ADVANCED PRIMERS OF ELECTRICITY. By Edwin J. Houston, A. M. New York: The W. J. Johnston Co., Ltd., 41 Park Row. London: Whittaker & Co., 1893; 330 pages, 88 illustrations. Price, $1.

This, the third and concluding volume of Prof. Houston's "Advanced Primers of Electricity," is devoted to the telegraph, the telephone, electrolysis, electro-metallurgy, the storage battery, electro-therapeutics, electric annunciators and alarms, electric welding, electricity in warfare and several miscellaneous applications of electricity.

These subjects are handled in the admirable and lucid manner that characterizes the writings of Prof. Houston. The extracts from standard authors at the end of each primer are a feature that has been highly praised in the preceding volumes, and has been retained in the present one. Each primer is, as far as possible, complete in itself, and there is no necessary connection between the several volumes of the series.

LECTURE NOTES ON THEORETICAL CHEMISTRY. By F. G. Wiechmann. New York: John Wiley & Sons. 1893. 8vo, cloth; pp. 222. Price, $1.50.

This little work is calculated to fill a decided want in the English scientific literature, presenting, as it does, a short text book on theoretical chemistry, which discusses the various molecular theories and relations between the physical and chemical properties of matter in an elementary and lucid manner. The brief but comprehensive manner in which the book is written renders it especially serviceable for the beginner, but it also presents a highly acceptable review of the whole subject, which will be of great value to every one who desires to post himself on a subject which is gaining daily in practical as well as in theoretical importance.

THEORETISCHE CHEMIE. Von Dr. Walther Nernst. Stuttgart: Verlag von Ferdinand Enke. 1893. 8vo, paper; pp. 590. Price, 12 marks.

This excellent work gives additional evidence of the growing importance of the subject of theoretical chemistry. The author treats the theme on the basis of the rule of Avogadro and the laws of thermodynamics in a very exhaustive manner, and therefore its discussions will not be only of interest to the chemist, but also to physicists, engineers and others engaged in the various arts which have their foundation in physics, and in thermodynamics more especially. The subject is treated in four books prepared by an introduction into the fundamental principles of scientific investigation. The first book discusses the general properties of matter. The second book has for its subject the atom and the molecule. The third book treats on chemical affinity and the changes of matter, and the fourth and last book on the changes or conversions of energy. Each book comprises a number of chapters, the different topics of which are elaborately indexed, both alphabetically and by subjects. The book will prove equally valuable for study as well as for reference.

GAEHRUNGSTECHNISCHES JAHRBUCH. Von Dr. A. Schrohe. Berlin: Verlag von Paul Parey. 1893. 8vo, cloth; pp. 258. Price, 6 marks.

This is the second annual edition of a series designed to record the progress in the industries based on fermentation and in kindred arts from year to year. The present volume covers the year 1892 and gives a short but comprehensive review of the improvements and discoveries made in brewing, distilling, yeast making, manufacture of wine and vinegar within that period. The two closing chapters are devoted to the progress in refrigeration and the manufacture of starch, dextrine and glucose.

ILLUSTRATED CATALOGUE AND PRICE LIST. Iron and Brass Pumps for Hand, Windmill and Power; Hydraulic Rams; Artesian Well Brass Cylinders; Pump Fixtures, Well Tools and Supplies. The Deming Co., Salem, Ohio, U. S. A. 1893. Cloth, 8mo; pp. 232. Free to patrons.

The above catalogue is, we think, one of the most complete general pump catalogues we have ever seen. Opening with an extensive telegraph code and some pages of condensed information or rules, applicable to pumps, concerning speed, power, capacity, etc., and other pages giving figures and formulas relative to pumps, tables of discharges for single-acting pumps and of powers required, and general classification, the catalogue then proceeds to a minute description of each class of pump, to wit, cistern, house force, shallow well, windmill, power force, double-acting force, rotary force, fire apparatus, hydraulic rams, etc., of each of which there is a wide range of sizes and forms, with all kinds of fixtures and pump supplies, hoses, etc. The catalogue is invaluable to our readers.

STEAM ENGINES AND BOILERS. The Murray Iron Works, Burlington, Iowa. 16mo, paper; 32 pp. Free on application.

This is the latest revised catalogue of the Murray Iron Works, who manufacture not only engines and boilers, but also refrigerating machinery, smoke stacks, heaters, steam pumps, inspirators, injectors, steam fittings, pipes, etc. The catalogue is very complete and explicit, and exceptionally carefully illustrated and printed.

——H. B. Stout has sold the Standard ice plant at Anderson, Ind., to A. C. Rice for a consideration of $3,000.

——The Michigan Lake Ice Co.'s office at Toledo, Ohio, was burglarized August 27. The safe was badly damaged, but no other loss was suffered.

ICE AND REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION, THE TEXAS ICE MANUFACTURERS ASSOCIATION AND THE FLORIDA ICE MANUFACTURERS ASSOCIATION.

∵ OCTOBER, 1893 ∵

RATES OF SUBSCRIPTION.

IN ADVANCE, POSTAGE PREPAID.

United States, Canada and Mexico, - - - - - $2.00 a Year
All other Countries, - - - - - - - - 3.00 "

Single copies 25 cents. Advertising rates on application to the offices. Remittances must be made by post-office orders, postal notes, international money orders, checks or drafts on New York, Chicago or London, payable to H. S. RICH & Co.

H. S. RICH   S. P. FOWLER   J. F. NICKERSON   JNO. GLENN COLLINS

H. S. RICH & CO.
PUBLISHERS,

177 La Salle St., Cor. Monroe, CHICAGO.   206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

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MAKING A TEST.

THERE are various ways of testing refrigerators, but the accidental test of his own, made recently by David Jacobs, interested in the Buffalo Meat Co., at the Fifty-second street market, New York city, was one that is not likely to become popular with the trade. Just before the store closed in the middle of the day Mr. Jacobs went into the room to examine the stock of meats. In the meantime the clerk, thinking he had gone home, locked the door of the room and went home also. A short time afterward, Mr Jacobs, having finished his examination, attempted to get out. He found that the door was locked. His experience "in cold storage" he has briefly related as follows: He realized that in a short time he might be frozen to death. He kicked the door and shouted until he was hoarse. No response came, and he tried in his desperation to break the heavy iron bars on the windows. His efforts were futile. He stood still awhile, debating what to do next. He began to feel sleepy and realized that he was slowly freezing to death. He tried running, but found he could not keep up his circulation; the space was too small. Finally a thought struck him, and he took down several large pieces of meat. These he began throwing from one side of the room to the other. He is a strong, robust man. He kept up his impromptu ball game until his back ached and he was nearly exhausted. He dared not stop, for fear that it would cost him his life. After several hours the clerk came back. He opened the door of the room. Mr. Jacobs tumbled into his arms. He hastily summoned a doctor, who applied restoratives. Mr. Jacobs was found to be seriously ill. He was taken to his home in Tompkins street, Stapleton, S. I. He is sick in bed as a result of his experience. His doctor says he will never fully recover.

WORLD'S FAIR TESTS.

THE World's Fair committee on awards (Professors J. E. Denton and D. S. Jacobus, of the Stevens Institute of Technology, Hoboken, N. J., and P. J. McMahon, Esq., of New Orleans), to whom was referred consideration of the ice and refrigerating machines on the grounds, for test of capacity and efficiency, have made a thorough and exhaustive test of the one absorption machine shown—that of Messrs. Henderson, Thoens & Gerdes, New Orleans. The finding of the committee, we can say, will prove, when published, entirely satisfactory to that machine, but the report itself is not yet ready for the printer. The editor of ICE AND REFRIGERATION expects to be able to publish it, with remarks of the committee on the compression machines, in the November issue.

ANSWERS TO CORRESPONDENTS.

HEATING OF ROOMS—TESTING DISTILLED WATER—SMOKE CONSUMER—CAPACITY OF ICE MACHINE—REFRIGERATION FROM THE SOIL—STOPPING A LEAK.

[This department of ICE AND REFRIGERATION is conducted for the benefit of the trade generally, as well as individuals; and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

HEATING OF ROOMS.

To the Editor: What is the approximate cost, *in coal,* of heating, say 1,000 cubic feet of air (room of common form), under average conditions, the average lowest temperature (to be raised to an average of 70°) being 30°? The room to be heated is 160 feet long by 76 wide and 78 high, the heat to be obtained from steam pipes. The inquirer is desirous of making an estimate of cost in coal of heating this room, or of bidding for the job of heating the room. W. O.

ANSWER.—The first part of your inquiry—the abstract question as to amount of coal required to heat 100 cubic feet of air from 30° to 70°—is easily enough answered. One pound of average coal has an evaporating efficiency for fifteen pounds of water from and at 212° F. This water while being evaporated in this manner has absorbed $15 \times 960 = 14,400$ units of heat; 100 cubic feet of air weigh about 8.07 pounds, and require $40 \times 8.07 \times 0.25 = 80.7$ units of heat to be warmed from 30° to 70° F. Consequently one pound of coal would be able to heat $\frac{14,400 \times 100}{80.7} = 17,800$ cubic feet of air, or 100 cubic feet of air would require $\frac{1}{178}$ pounds of coal, to be heated in the manner required. This theoretical information, however, will be of little service in answering the second part of your inquiry, which is entirely different from the first, it being entirely practical, involving the loss of heat in being applied to the steam boiler, which varies from 30 to 70 per cent of the absolute heating capacity of the fuel, the loss due to radiation of walls, the loss due to ventilation, the fact that the rooms have to be kept warm, and a number of other considerations not mentioned in your query, and if they were mentioned they would be of little use in answering the principal question in a manner practically available for your purpose, practical experience being a much safer guide in such a complicated case than theoretical calculations. From the records of such practical experience we lean to the statement that in heating large rooms by steam practically one boiler horse power will heat 10,000 to 15,000 cubic feet of air space, according to outside temperature, reference being had to the necessary ventilation, occupancy and probably generally covering just such conditions as you refer to. One boiler horse power is equivalent to the evaporation of thirty pounds of water at seventy pounds pressure per hour, and will require $900 \times 30 = 27,000$ units of heat, to produce which nearly two pounds of average coal would be required theoretically (see above), and allowing for loss (in heat being applied to steam boilers) as much as two-thirds, not over six pounds of coal would be required practically to heat 10,000 cubic feet of air space, or $\frac{6}{100}$ pounds of coal would be required to heat 100 cubic feet in cold weather, and less in warm weather; that is, for every hour the rooms are to be warmed. Applying this to the concrete example given in your example, the room to be warmed being $160 \times 76 \times 78 = 948,480$ cubic feet in size, it would require less than $\frac{948,480 \times 6}{10,000} = 560$ pounds of coal to be kept warm on an average per hour. If the heating plant were constructed after the most approved pattern, less than half the above amount of coal would be needed, and if the winter be a mild one, that would in itself reduce the amount of coal required all the way up to 30 per cent. Providing the above statements are correct, which I have every reason to believe they are, and assuming that the room in question has to be kept warm only about ten hours a day, I should judge that the amount of coal used during the season would be from 100 tons upward, and might reach double that amount, or over, in case of poor plant or extremely cold weather.

TESTING DISTILLED WATER.

To the Editor: Will you have the kindness to inform us through the columns of ICE AND REFRIGERATION of a simple way or method by which we can test distilled water, in order to find out if it is actually distilled or not? We take it that such a test will also be applicable to ice, to decide whether or not the latter is made from distilled water. P. F. C.

ANSWER.—Water if properly distilled (and of course ice made from such water likewise) if slowly evaporated on a piece of platinum foil on a spirit lamp or a burner, gas burner, should leave no solid residue. If care is used in performing the operation a piece of thin glass plate may be used instead of the platinum foil. As most natural water contains chlorides or sulphates or either of them, the addition of a drop of a solution of nitrate of silver or of chloride of barium to a sample of the water contained in a test tube or other small glass, will cause a white turbidity or precipitate in water which is not distilled or not properly distilled. If it is distilled water made in your own works which you desire to test, you can readily ascertain by a preliminary test which one of the last named chemicals will answer best for your purpose by simply testing your undistilled water with each of them, and thus find out which one produces the most turbidity in it. This one will be the best also to test your distilled water or ice with. Rain water if carefully collected, gives the same reactions with the above tests as distilled water.

SMOKE CONSUMER.

To the Editor: Can you recommend us a good smoke consumer? We have lately been obliged to run our engines to their full capacity, and our fireman has to hustle in shoveling coal, and a great portion of the same is wasted in smoke, it appears, and for this reason we should like to have something which stops this waste and the nuisance at the same time. Please advise us in your next issue. A. T. F.

ANSWER.—If you crowd your boiler, or rather its fireplace, too much it will smoke in spite of a smoke consumer. The principle of most smoke consumers consists in a uniform and gradual distribution of the fuel over the grate, and this at least in a great measure can also be accomplished by an attentive and careful fireman. But of course there is a limit to the amount of coal that can be made to undergo perfect combustion in a fireplace of given size and with a chimney of given height and diameter We think that most likely the height of your chimney should be increased, and this, too, whether you use a smoke consumer or not. We are not in a position to advocate any particular make of smoke consumer, and its selection in your case will depend on local conditions also. But as you will doubtless have to provide for more draft, you might do that first and then consider the advisability of putting in a smoke consumer after that.

CAPACITY OF ICE MACHINE.

To the Editor: What size of an ice machine (ammonia machine, direct expansion) is required to do among others the following duty. viz.: Refrigerate eighty barrels of beer wort from 70° F. down to 40° F. (by means of a so-called Baudelot cooler) in two hours' time? Of course I expect the machine to do other work besides this, but as the above is the greatest efficiency required at any one time I thought it would be proper to gauge by it the size of machine required. G. B. H.

ANSWER.—Assuming the specific gravity of your wort to be 1.053, which is averaging the ordinary run, and assuming further that a barrel holds thirty-one gallons (a gallon of water weighing 8.3 pounds) the weight of the amount of wort to be refrigerated in two hours is equal to

$$80 \times 31 \times 8.3 \times 1.05 = 21,613 \text{ pounds.}$$

If we further assume the specific heat of the wort to be 0.93 the amount of heat to be withdrawn amounts to

$$21,613 \times 0.93 \times 30 = 603,000 \text{ calories.}$$

This represents the amount of refrigeration required to be performed in two hours, but as the capacity of ice machines is expressed at the rate of twenty-four hours' work, the actual refrigeration required in that time is

$$603,000 \times 12 = 7,236,000 \text{ calories}$$

or

$$\frac{7,236,000}{284,000} = 25.4 \text{ tons.}$$

In other words, a machine having an actual refrigerating capacity equivalent to about twenty-five tons of ice at 32° changing into water of 32° would do your business, but a somewhat larger machine will do no harm; on the contrary, we would think it advisable to have it so.

REFRIGERATION FROM THE SOIL.

To the Editor: We have recently read something about a cold storage apartment, which is to be built by means of sewer pipe being laid a certain depth below the ground, and for a certain length through which the warm air passes, and by the time it reaches the apartment is sufficiently cooled, so as to dispense with the use of ice. The cool air is then carried away through a high chimney. We also inclose the opinion of one of your contemporaries on the subject and should like to know what advice or recommendation you may have to offer on this subject. G. H.

ANSWER.—We also do not know of any instance where this system of cooling is actually employed, and think that it can hardly be used for real cold storage, except, perhaps, in localities especially favored. In this respect we are very much of the opinion of our contemporary referred to, which reads as follows: "The principle seems correct, but the power of a natural circulation appears weak. The air, when it becomes cool in the subterranean pipes, is disposed to stay there, like the air in wells and cellars, and, unless some positive means are employed to produce a fixed condition of circulation, the apparatus would be of little value. The natural draught of a chimney, without heat, is as liable to be downward as otherwise. Again, if artificial draught is produced, it should not be in excess, as a strong draught through the subterranean pipes would soon warm the passages and ground and destroy its cooling properties. Under any circumstances the amount of cooling effect must be small, as the temperature of the ground in summer, at a depth of four feet, is seldom cooler than 55° F. In order to obtain a temperature of 60° in hot weather the subterranean exposure should be very large, we should judge not less than one square foot for every cubic foot of space in the cool room, with a moist ground for the unglazed tile pipe. Then, if four-inch tile pipe is used, it will require 1,000 feet for a cool room of 10 feet × 10 feet × 10 feet, which may be divided into two or more sections, leading in different directions. In very dry ground we should judge that 50 per cent more pipe should be used. For artificial draught a small fan, driven by electricity, a wheel train and weight, which may be wound up by a small windmill, will be the most available power, otherwise an up-draught ventilator may be made available when there is any wind. The use of fire for creating draught in the chimney will be troublesome and expensive, unless the cold room chimney could be warmed by a flue used for other purposes. The more porous the tile pipe can be made the better results will ensue, as it must absorb the water of condensation from the cooling air, and also be a partial feeder of air from the ground." But little can we add to this, except, perhaps, that it would be advisable to avoid the use of air saturated with moisture, as the condensation of water above referred to is a source of heat production which we should avoid. On the contrary, if the air before entering the subterranean channels could be made to undergo some process of drying so that it would have to absorb moisture instead of depositing the same while passing through these pipes, the efficiency of the arrangement would be increased correspondingly.

STOPPING A LEAK.

To the Editor: Our freezing tank has been leaking for about two years, and, as it is impossible to get to the bottom of it, I thought there might be something that we could put in the brine that would find the leak and close it up. If you know of any way of stopping the leaks, kindly let me know. I. K.

ANSWER.—The proposition you make is certainly a very ingenious one, but at the same time quite a novel one to us, for which reason we are unable to give you any ready advice. While it appears not altogether unfeasible that your plan may be successfully followed, if the right substance were used, still it would be somewhat risky to experiment much in the brine tank. The addition of pulverulent substances, such as ground clay, would suggest themselves for a trial, yet they might also tend to clog the brine pump valves, or do other damages. These dangers would still increase if substances of a chemically active nature were added. In publishing your question in ICE AND REFRIGERATION it may be that one or the other of our readers will offer some practical advice on this subject.

——The ice factory at Redlands, Cal., is now operated by electricity.

——The contract has been let for the rebuilding of the portion of the Morrill packing house at Ottumwa, Iowa, which was destroyed by fire not long ago.

——George Bartholomew, of Lancaster, Pa., and Charles C. Rowe, of Emmittsburg, Md., were repairing an ice making machine at Mt. St. Joseph's academy, and supposed that all the ammonia gas was cut of it. But when they removed a leaky valve to repair it, a large volume of gas rushed out upon them, burning Bartholomew's breast and arms into blisters, his shirt, where the gas struck it, being frozen stiff.

——The Transparent and Independent Ice Co.'s, of Washington, D. C., have been merged, the negotiations closing September 7. By the consolidation the former company loses its individuality. For some time the Transparent people have not been manufacturing the bulk of the ice sold to the public, but have been getting their supply through the Independent Ice Co. The representatives of neither company will give out the reasons or considerations of the consolidation. It is understood that Mr. Alex. Ward, who for several years has been general manager of the Transparent company, will not be connected with the new management.

THE ICE TRADE

THE TRADE.

THE retail season is rapidly closing; and, from all advices in our hands, it has been a very satisfactory one. The volume of sales has been large, and prices have been remunerative and well maintained. Even the recent "squeeze" in money seems to have had little effect on sales, it being more economical to buy ice than to waste such foods, etc., as ice would save.

THE "machine" ice has quite held its own, and a little more, this season; and yet the variety and vigor of the attacks made upon it have been rather more marked than usual. In all these battles the ice has come out with honors and a "clean" reputation. The day when machine ice can be decried as impure and unwholesome has gone by; and the onus or burden of proof has been shifted to other shoulders.

SOME business experiences with a moral attached have come to light during the recent business "squall," which are not without interest—conspicuously the fate of one or two "co-operative" ice companies, organized, of course, to "resist the giant of monopoly," and to "grind the tyrant ice man's head under the heel of suffering humanity," *et id omne*. The fate of the "co-operative" has not been favorable to the perpetuation of the scheme among careful business men, whether we examine the wrecks at Cleveland or Paterson. Ice cannot be handled at any such prices as most co-operative promoters figure out on paper, and any attempt to do so is sure to result in a loss, and in conveying to shareholders the information that ice dealers are like other men: must be content with a fair profit, beyond which it is seldom possible to go in these days of close competition and nimble capital seeking profitable employment.

THE Knickerbocker Ice Co., of New York, by one of its representatives, announces in the Poughkeepsie *Eagle* that it will "next winter put in ice sufficient to supply the retail trade in all the cities on the Hudson river, including Albany. The house at Poughkeepsie will hold 8,000 to 10,000 tons. Some men will be sent to that city before frost comes to repair the road from the house, which is in bad condition. They will adopt a different plan of delivery to families leaving the ice in receptacles only prepared in front or rear of their houses, and not carry it up stairs or down cellar, as is now being done. This will enable them to make a reduction in present prices of nearly one-half."

THE ice factories have done a good business at Savannah, Ga., says a local paper, and, despite a cut-rate war in the early part of the summer, during which the public practically got its ice for nothing, the value of the annual output has increased. The Charleston Ice Manufacturing Co. has now a daily capacity of seventy-five tons, and the Palmetto brewery ice plant twenty-five tons. During the past two months the price of ice has advanced from $2 a ton to $6 a ton.

AN Eastern exchange says that "more ice was given away last summer to indigent and impecunious people in all the cities of the country than was ever before assured them in a hot season." The general judgment is that these free gifts saved human life in many instances where, had not the cooling crystal been within reach, death would have resulted. It may also be added that systematizing of the use of ice has had much to do with the beneficial results secured therefrom. Heretofore men engaged in out-door work in the summer were too frequently allowed to indulge excessively in ice water, as was the case in many of the great industrial operations. This has been gradually overcome by means of rigid regulations, as is the use of the same luxury in hospitals, homes and other places of refuge and resort, where it is furnished in ways to benefit and not injure consumers. Ice is destined hereafter to become a much more popular article of food than it ever was, and it will also be made as conducive to health under proper restrictions as are bread, potatoes, tomatoes, etc.

IMPURE ICE QUESTION.

DR. James A. Steuart, secretary of the Maryland state board of health, received recently the results of chemical analyses made by Dr. W. B. D. Penniman of ice sold in Baltimore. Dr. Penniman says the analyses of ice, naturally or artificially frozen, show that the supplies sold in Baltimore are of a high degree of purity. There is no danger to the public health, he adds, from the ice used in the city. Most of the water which is frozen artificially is first distilled or filtered, or both.

THE city solicitor of the city of Ottawa, Canada, on October 13 rendered the following decision, in answer to Dr. Robillard's question as to whether he can prevent the importation, by Mr. Levi Booth, of the ice from Lake Champlain: "Under Sec. 55 of the public health act it is in the power and within the jurisdiction of the board to adopt such regulations in reference to the source of the supply and the place of storage of ice as shall in their opinion be best adapted to secure the purity of ice and prevent injury to public health, and to supervise ice supplies imported or to be imported for use within the municipality. This power does not, in my opinion, confer on the board the right to absolutely prohibit the importation of ice, unless the ice imported

or proposed to be imported is impure or liable to injure the public health. The regulations of your board now in force do not assume to do this."

As A fair sample of what our old friend, "Mr. Sparkler," would have termed "biggod nonsense," the following interview with a Brockton, Mass., ice (natural) dealer, printed by the Brockton *Despatch*, is quoted in full;

Artificial ice is all very well in its place, but the place is the south, and not here, for in this part of the country we have every facility for getting pure ice in the natural way.

Manufactured ice does not produce as much cold air as natural ice, and I will furnish ice free for one year to any one who will prove that it does. Besides this the artificial ice will not last any longer, and in time becomes porous, "rots," so to speak, and is then no good. It is softest in the center, as, when put in the cans, it freezes from the sides toward the center, and the latter part is therefore the last frozen, and, consequently, the least frozen. Natural ice is of the same hardness all through, and the last piece left is as hard as the first piece cut off, but with artificial ice the last piece is much the softer.

The reason that manufactured ice is apt to be impure is that mineral matter is often pumped from the well from which the water is taken, and so gets into the ice. Then the water which is used is dead, as it is boiled, and it is impossible to get all the oil out of the steam which passes through the engines and is finally condensed into water.

Natural ice freezes downward, and the impurities are thus driven to the bottom, but artificial ice freezes from the sides, and the impurities are driven to the center, where they remain, as is proved by the presence of the white streak which is to be seen in every cake of manufactured ice. That streak is made by the impurities which gather in the middle of the ice. Nature's method drives out all impurities, and the Almighty's plan is the only one which is absolutely perfect.

You may put a tub of soapsuds out in the cold, and, when it is frozen you can take pure ice from the top. This is only one illustration which demonstrates that the natural way is the best way.

The time when artificial ice looks best is just after it has been frozen. This is because it comes out of a mold, and is, of course, handsomely formed; but let it melt a little, and then compare it with the natural ice which has also melted somewhat, and you will find the latter the more beautiful.

The core in the center of manufactured ice grows larger as the cake grows smaller, and the ice melts from the center.

In conclusion this astute dealer told the *Despatch* man that he had visited at least a dozen artificial ice works in different parts of the country, and had never found one which had been in operation as long as two years whose proprietor would not admit that natural ice was superior to artificial ice; and also propounds the stunning query: "Can man do the work of the Almighty?" The local ice manufacturer, at whom this interview is aimed, very naturally took it up, and pulverized his opponent.

NATURAL ICE NOTES.

——The Haverhill (Mass.) Ice Co. will rebuild the ice house recently blown down.

——The Huse & Loomis Ice Co. have been dredging their ice cutting field near Acton, Ill.

——The Crystal Lake Ice Co., Waldoboro, Me., will build a stone pier at their ice houses.

——Nath. Stoudt and J. M. Bordner will build an ice house at Bernville, Pa., size 30×60 feet.

——The Seekonk Ice Co., Providence, R. I., have had to open up a second house to meet the demand.

——The ice house lately burned at Lake Whitney, near New Haven, Conn., will be rebuilt to hold 10,000 tons.

——J. F. Winkler will erect new ice houses on the site of those destroyed at Saginaw, Mich.. by the big fire of May last.

——A Grand Rapids, Mich., correspondent says prices have been well maintained through the season, and trade has been good.

——Mr. Spellman, of Rootstown, who has the lease of Congress lake, near Hartville, Ohio, for the ice, intends to erect another large ice house soon.

——J. S. Clark,of North Elm street,and W. A. Hatfield,of the Foster house, Springfield, Mass., are preparing to erect at Westfield a large ice house 40×20 feet, for their joint use.

——The addition to the Great Falls Ice Co.'s house at South Gardiner, Me., is nearly complete, and part of the roof has already been shingled. Quite a large crew is still at work on the buildings.

——Daniel Sandborn, Exeter, N. H., has made arrangements with the water works company to cut ice from the reservoir. He will at once erect a large ice house, to be ready the coming season.

——The Jamaica Pond Ice Co., of Boston, will at once build a block of ice houses sufficient to contain 60,000 tons of ice at Sharon, Mass. These will probably be duplicated next year. The company is now building a spur freight track to the site of the new houses.

——E. W. Twining is building an improved ice house on his properly in Yardley, N. H. It will be entirely above ground on the site of the old one, which has been filled up with stone and gravel to make a perfect drainage. There are three sets of weatherboards and two air chambers—that is, a room within a room and another room within.

——F. H. Daniels, Williamstown, Mass., has contracted with Gifford Bros., of Hudson, N. Y., manufacturers of ice harvesting machinery, for an endless chain elevator, with a capacity of twenty-seven cakes of ice per minute. He will increase the size of his ice house from one-third to one-half, and he says, if such a thing is possible, he shall store ice enough another winter to last through the year. He is now obliged to buy ice at Fitchburg at a cost considerably more than of that which he harvested.

——The Boston Ice Co., owning a controlling interest in the Crystal Lake Ice Co., Friendship, Me., have drained the lake, leaving forty acres unsubmerged. This has become quite dry, and they have set men at work clearing the bottom of sunken logs, old stumps, rocks and grass,and gathering the inflammable portions into heaps to burn. Arrangement has been made with the Union Granite Co. to supply the rough stone with which to build a good wharf to ship from.

——On August 29 the employes of the Consumers' Ice Co., at Hamburgh, N. Y., quit work, with an ice barge for New York half loaded. They said two weeks' pay was due them, and their pay roll should not have been delayed; that the company lease the ice houses, and that the lease will expire; that the company is a Maine concern, etc. Supt. Robbins tried to get the men to work,but failed,but at night the money to pay the men arrived, and they resumed work next day.

——Alexander & Co.'s ice supply, put up for Michigan City, Ind., last winter gave out late in August, and they have since been purchasing of Laporte companies. They have erected a new ice house near the railroad side tracks, into which they can unload the ice directly from the cars. Dick & Co., the other firm of ice dealers, have also almost exhausted their supply, and in a few weeks will also be compelled to purchase elsewhere to supply their customers. An extra amount of ice was put up by both firms last winter on account of its good thickness and the great amount obtainable. It was thought an ample supply had been secured, but this year a much greater amount has been used. Even at this part of the season more has been consumed than in all of last year.

——The Knickerbocker Ice Co., Philadelphia, has been awarded a medal by the World's Fair for exhibit of two ice wagons.

——The Crystal Ice Co., Youngstown, Ohio, will fit up a room in their cold storage house for the special work of caring for ladies' furs, woolens, etc.

——The Diamond Ice Co., Seattle, Wash., has completed the installation of its ice and cold storage plant, giving that city ample ice making and cold storage facilities.

——The Knickerbocker Ice Co., Chicago, has been awarded a medal by the World's Fair on ice wagons, dumping wagons, automatic folding vehicle step, ice tongs, needle bar.

——The stockholders of the Roanoke (Va.) Cold Storage Co. have resolved to apply for an amendment to the charter, allowing the company to increase its capital and extend its field of operation.

——The suit brought against the South Grand Rapids Ice and Coal Co. by the Grand Rapids Ice and Coal Co., for damages, has been decided in the lower court in favor of the defendants. It will no doubt be appealed to the court of last resort. The case grew out of the plaintiff's claiming that the defendant company was taking ice from a part of Reed's lake belonging to the Grand Rapids company.

——The certificate of incorporation of the Brooklyn Hygiene Ice Co. was filed September 14. The company will maintain cold storage warehouses as well as manufacture ice. The capital stock is $250,000. John H. O'Rourke, John Bray, James Lennon, Sr., Frank Keane, George Frush, James Lennon, Jr., Peter J. O'Rourke, William H. Keane, Richard Cronin, Robert Avery and Gregory Cox are the incorporators.

——The annual festival of the employes of the New York Knickerbocker Ice Co., connected with the east New York and Newtown creek depots, was held in the afternoon and evening of September 14, at Benner's Ridgewood grove. The friends of the men turned out in full force, and some of the officers of the company attended. Employes from other depots went in the evening, and received a royal welcome. The pleasure was of "full weight," and nothing was "short" which tended to enhance the comfort of their friends. Dancing was the main attraction, and that pavilion was crowded.

THE extreme closeness of the money market has been relieved during the past month, and there is a much easier and more hopeful feeling in business circles. Still so far as appears there is as yet no marked improvement in inquiry with reference to ice machines. Many of the works have been running very quietly in anticipation of a dull trade this fall, and they may not be disappointed. Nevertheless, there is no sign to indicate that exceptional quiet will be the rule; on the contrary, we have heard of the placing of a few big orders that will keep some of the works going all winter; and we believe that more will be booked before the fall closes. By the law of averages, the coming winter should be a mild one, and that will stimulate inquiry and create business, and the continued advance of the ice machine northward is a fact that requires no array of facts to prove. The "impure ice" discussion has not been without its advantages to the machine men, for in nearly all recorded cases this summer the anti-machine men have been illy provided with facts and have furthermore almost invariably lost their temper, with the usual "break down" when the test came.

The past month has but a meager showing to make. The record, however, is as follows:

ARIZONA.

Yuma.—It is expected that the Yuma Water and Light Co. will put in an ice machine this winter.

CALIFORNIA.

Mentone.—Mr. Milligan expected to have his new ice factory in operation on September 10.

Redlands.—The Union Ice Co.'s 75-ton ice plant is now in operation.

DISTRICT OF COLUMBIA.

Alexandria.—Additional machinery is being added to the ice factory which will double its present capacity.

FLORIDA.

Eau Gallie.—The machinery for the ice factory arrived early in September. The plant will make twenty tons of ice daily.

Key West.—The new ice factory will be ready for operations by October 1.

NORTH CAROLINA.

Raleigh.—The Hygienic Ice Co.'s plant, recently burned, will be rebuilt.

NEW JERSEY.

Cape May.—Samuel E. Abrams, Joseph Cohen, Augustus Rosenbaum and John J. Conroy, of Philadelphia, have formed a coal and ice company and will erect a $25,000 ice plant.

TENNESSEE.

Murfreesboro.—A $12,000 ice factory is in course of erection, Knoxville parties furnishing the money. The company will be known as the City Ice Co., with James W. Perry, manager.

TEXAS.

Denison.—The Denison Crystal Ice Co. will erect a 75-ton ice factory here, to supply the southwestern trade. The land has been bought and the plant will be installed this winter. The present factory (40-tons daily) will be kept running as usual.

Orange.—The Orange Ice, Light and Water Works Co. will expend $10,000 in improving its plant.

NEW COLD STORAGE PLANTS.

THE following is the record of new work projected and completed during the past month.

CONNECTICUT.

Hartford.—W. C. Wade, butcher, etc., has put in a complete ice machine for making his own ice and cooling his market.

MAINE.

Boothbay Harbor.—The cold storage house has been put in first-class order, and the handling of fish began early in September.

OHIO.

Cincinnati.—On August 21 the workhouse ice house was completed, and on August 22 the first lot of ice, consisting of fifty tons, was stored away. The ice will be furnished hereafter in such quantities as is required. The ice house is a miniature cold storage warehouse, in which all the food used in the institution is stored.

PENNSYLVANIA.

Greensburg.—The ice factory, which has been in successful operation the past summer, will enlarge its cold storage facilities by adding to the 400-ton capacity room for 700 tons more.

SOUTH CAROLINA.

Charleston.—At a recent meeting of the subscribers to the capital stock of the Cold Storage Manufacturing and Transportation Co., more than 60 per cent of the stock was subscribed, and the balance has been asked for by northern parties. The following were elected as directors: C. F. Myers, A. S. Grant, Wm. Mappus, D. T. West and J. P. Croghan. At a subsequent meeting of the directors the following officers were elected: C. F. Myers, president; Wm. Mappus, treasurer; G. W. Meyer, secretary and manager; E. P. Hollings, solicitor. The company proposes to enter into the shipment of vegetables, etc.

WEST VIRGINIA.

Weston.—The superintendent of the West Virginia Hospital for the Insane will add to that institution an ice house with cold storage room. The building will be one story high, of brick with slate roof, and seventy-four feet long and thirty-two feet wide, with an L twenty-five feet wide. The work will be completed on or before December 15 next.

WISCONSIN.

Berlin.—Mr. Safford is converting a part of his warehouse into a cold storage, to be 32×48 feet, two stories and basement, with ice room above the second story. The Dexter system of construction will be employed.

THE "Patent and Trade-Mark Congress" in the series of international congresses to be held in Chicago in connection with the World's Fair, will be held at the Art Palace, Lake Front, beginning October 2, and continuing through the week. The subject is one of very great importance to the world; and in consequence the literary programme is exceptionally strong.

——J. W. Parsons has retired from the Iona (Mich.) Ice and Fuel Co.

——Mr. Peter's ice house, at Barneston, Neb., was burned September 18.

——Judgment for $3,764 was entered September 20 against Austin & Babcock, ice dealers, New York city.

——The Dow S. Kittle Provision Co. has been incorporated at New York, by Dow S. Kittle, Chas. A. Kittle, New York, and A. D. Kittle, Blauvelt; capital, $50,000.

——The Trescott Packing Co. has been incorporated at Portland, Ore., to handle fish; capital, $20,000; incorporators, J. Williamson, Frank Hannesey and Herbert S. Martin.

——The California Fruit Transportation Co. will build a fruit shed and ice house at Biggs, Cal. The shed will be 100×28 feet, and will be erected at the switch. The ice house will be 14×16 feet, with a capacity for two car loads of ice.

——The Upper River Ice Co., Fort Dodge, Iowa, will build another ice house in the near future near the ones now in use. The building will be 100×50 feet. This step is made necessary by a demand upon the company for ice that has exceeded the capacity of the two ice houses it now has. The company has been out of river ice for some time, and at present, in order to accommodate the trade, paid in August more for ice than its customers, getting it from Storm lake, and paying $5 per ton for it on track there, the same price they are selling it for in Fort Dodge, by which they lose the shrinkage, drayage and freight. They propose, however, to care for their customers.

——Smith, Hallett & Co have leased the old Transparent Ice Co.'s factory at West Washington, D. C., which they are now thoroughly overhauling and putting into first-class condition. The head of the new firm is M. W. Smith, who was chief engineer at the Hercules Iron Works World's Fair plant until its destruction by fire, July 10 last. Prior to that he had been for some twelve years or more in charge of various plants in the South, seven of which were spent with the Consumers' Ice Co., New Orleans. His partners, Francis Hallett and Curtis M. Smith, are all practical men, thoroughly up in the trade, and as ice is sold from the platform in Washington twelve months in the year, there seems no reason why the new firm should not be entirely successful.

THE packing houses of Kansas City, during August, indulged in the luxury of a strike, brought on by a 10 per cent reduction in wages. The strike affected about all the packing companies for a short time, but as men were plenty none of the houses suffered inconvenience, and all are, and have been, running up to full requirements.

THE new abattoir of the People's Slaughter House and Refrigerating Co., New Orleans, has been completed, and is now ready for use. The slaughter house has a frontage of 250 feet on the river, and is 2,000 feet deep. It is provided with every modern appliance of refrigerating machinery, etc. The method of killing is the same as in vogue in all modern slaughter houses, with the additional improvement in the present establishment of an automatic trolley system, by which the beef, after being killed, is carried from the bleeding room to the skinning bed, and thence to the chill room or cold storage. This department is divided into six sections, five for cattle and one for hogs, and has a capacity of 250 head per room. These compartments are chilled by the brine system, cooled by two De La Vergne refrigerating machines, of fifty tons capacity each. The adjoining stock yard is a model cattle pen, and has room for 4,500 head of cattle and sheep. The capital stock of the company is fixed at $300,000. The officers are: David Jackson, president; J. W. Westerfield, vice-president and general manager, and Louis T. Dugazon, secretary.

MEANTIME the older abattoir company of the city, the Crescent City Stock Yard and Slaughter House Co., Limited, successors to the original company organized in 1869, has recently enlarged its slaughter house by the erection of a new building containing twelve slaughtering rooms, which is very complete in all its appointments. Slaughtering is done for the trade, who purchase stock in the adjoining yards, which are turned over to the killing house, accompanied by the state inspector of live stock, authorizing its slaughter. No animals are killed here after 6 P. M., or two hours after the close of the live stock inspector's office. The company employs over fifty men, and the business done at the landing itself gives employment to over 400 men. The company owns property also on the right bank of the river, where the original slaughter house was located, but which has since been abandoned and used as a pasturage. The present location of the company on this side of the river is admirably fitted for the handling of stock. It is flanked on either side by plantation lands which have been converted into pastures with a capacity for 100,000 head of cattle, and for miles down the river can be seen droves of cattle grazing on the tender grass which abounds in that section. The Crescent City Live Stock Landing and Slaughter House Co. has been known throughout the country by reason of its prolonged litigation, but its affairs are now completely out of the courts and the greatest cordiality exists between the officers of the company and their customers.

THE report of the British royal commission on the subject of marking meat, in order that the consumer may readily and certainly distinguish between native and foreign meat imported dressed, in its recent report recommends that all shops selling imported meat should be registered and bear outside a prominent sign so that every one will know that the home-fed article is not kept within. They also recommend the inspection of shops, as under the food and drugs act, by duly qualified inspectors. In the case of mutton a metal tag passed through the shank bones and sealed is recommended. It is also suggested that more attention should be given to the idea of electric cautery, so that inventors may devise some means of cauterizing which, while being effective, will at the same time be cheap. As many interesting points were raised during the inquiry, the committee desire to be reappointed (by the house of lords) so as to continue collecting evidence of a similar nature to that now published.

PACKING HOUSE NOTES.

——The new abattoir for the Knoxville, Tenn., butchers is now ready for use.

——Swift & Co. are erecting at Waterbury, Conn., a meat refrigerator 100×40 feet in size.

——The Iowa City (Iowa) packing house has gone into the hands of a receiver, owing to scarcity of currency.

——A large pork and beef packing establishment will be located on the outskirts of Augusta, Ga., by Bryan Lawrence and other Augusta men.

——The Bloomington Pork Packing Co. has been incorporated at Chicago, with capital of $100,000, by Wm. Van Schaick, J. C. Harvey and B. D. Lucas.

——The Nashville (Tenn.) Packing Co.'s plant will be ready to begin work by October 25. The plant will have capacity for 200 cattle, 500 sheep and 1,000 hogs daily.

——The packing house at Fort Worth, Tex., has been closed during the financial depression, but it was announced that the syndicate would open it about September 15.

——It is announced that hereafter the system of government meat inspection will be extended to meats destined for home consumption as well as for export, beginning October 2.

——An authentic report from Port Said, on the Suez canal, where the new refrigerated meat stores were recently started, gives the sales for one week to passing steamers as 20,000 pounds Australian meat.

——It is said that instead of reducing business, the Cudahy packing house at Milwaukee during August killed on an average 2,000 hogs per day as against 800 in August last year. There are 480 men employed. Work is being pushed rapidly on the new site at Cudahy. It is expected that slaughtering will commence about October 1.

——The operations at the packing houses of Kansas City for the next six months will, it is expected, largely exceed those for the corresponding period in 1892. The temporary depression which this industry experienced during the financial flurry has passed away, and all of the plants are increasing their force and are gradually working up to their full capacity.

——The assignee of the Sioux City Dressed Beef and Canning Co., one of the institutions that failed here, sends out a statement to its creditors of its assets and liabilities. The liabilities are $270,000, and assets are estimated to be worth about $10,000. The company had a valuable plant, but it is covered by the mortgage on all property of the stock yards company, on which foreclosure has been commenced.

——The Cincinnati Packers' and Butchers' Manufacturing Co., which is intended to convert into fertilizer the waste material of the slaughter and packing houses of that city, was organized on 'change September 18. The incorporators are George Zehler, Ferdinand Schroth, Jacob Vogel, Jr., and Sigmund Frietsch. The capital stock is fixed at $50,000. The plant will probably be located on Spring Grove avenue.

——An interesting law point appears in the case of *Armour Packing Co.* v. *Geo. E. Burt*, to be heard soon at Minneapolis. Burt had made an assignment, and the plaintiff claims that at the time the assignment was made the insolvent had a half car load of lard, which had only just been received. This he turned over to the assignee. The packing company claims that the lard was not received while Burt was solvent, and hence is the property of the shipper.

ICE IN LONDON.

IT is refreshing to read about ice in the torrid days, says a London correspondent of the *Butchers' Advocate*. The mere sight of the article in the shop windows is a luxury; and the hot spell has had the effect of making such a spectacle by no means uncommon. Nor, though it may seem a strange thing to say, is the extra demand for it lessening the supply; it is having the other effect. It would do so, of course, were we wholly dependent on the natural article—on the huge, crystal-like blocks from North America and Norwegian lakes, that are stored up "in cool grot" underneath the ground, and samples of which look so inviting in summer as they pass into grateful liquidity, either from the mass or from the chips that find their varied uses at table. A few days in the seventies, however, not to speak of the eighties into which we have gone, or of the nineties into which we are verging, soon bring emptiness into the realms of cold storage; and, indeed, it is no longer profitable to lay up abnormal supplies of ice. Our summers are, as a rule, too cool to make the investment a desirable one; but the marketable value of the article is affected even more by the fact that ice making has become an industry. The production of the article is now, as far as human needs are concerned, made independent of the seasons. It can, in fact, be turned out much more expeditiously in midsummer than in midwinter. Taken fresh from the mold, it is, for most purposes, more serviceable than that which has lain in chilly security for six months. It is really, as we now handle it, as much a product of the days of warmth and sunshine as are strawberries and peaches and watermelons. We have not as yet gone so far in our demands upon the ice factory as the Americans, and we are not likely to do so, iced drinks being in our case simply a makeshift, and not, as with them, a matter of course. But that which with us was a few years ago only an experiment is now in use in all our towns, and it is a very small community indeed which does not to day have ice making appliances among the resources of civilization to which it can lay claim. In some of the larger factories hundreds of tons of ice a day can be turned out; and it is not surprising to learn that during the present week the full limit of production has been reached. And these ice factories serve a double purpose. They have their frigidaria, in which dead meat can be kept for an indefinite time secure from those processes in which nature, left to herself, is sure to reclaim her own. In such places, also, butter, that under present thermal conditions requires the ladle more than the knife, can be stowed away firm and compact, and drawn upon as demand requires. It is comforting in the sweltering heat to reflect that there are spots like these, it may be in the next street, where, so far from the mercury forcing itself up to fever heat, it is going down to zero. And the hot days, it is also pleasant to remember, have had a good effect on certain classes of trade.

FIRE AND ACCIDENT RECORD.

——The ice factory at Mt. Vernon, Ky., was burned by an incendiary fire September 10.

——During a wind storm at Acushnet, Mass., September 8, one of the ice houses of C. A. Sisson was blown down. Loss, $1,500.

——One of the two ice houses of the Santa Fe road, at Newton, Kan., was burned September 12. Loss, several hundred dollars; cause, unknown.

——Roberts & Low's ice house at Williamsburg, Ind., was recently burned.

——The ice houses of the New York Central hotel, Niagara Falls, N. Y., was burned August 19. Loss, $1,000; insured.

——The Knickerbocker Ice Co.'s house at 140 Fifty-third street, Chicago, burned September 1. Loss, $10,000; insured.

——The cold storage house of L. L. Putnam, Albion, Mich., was burned about September 1. Loss, $20,000; insurance, $12,000.

——By the bursting of a steam pipe at the ice factory at Bessemer, Ala., Mr. H. G. Meumann was recently quite badly scalded.

——The east half of Wood Bros.' ice house, at Sugar lake, near Atchison, Kan., collapsed September 19. The house was entirely empty.

——On August 24 fire appeared in the stables of the Consumers' Ice Co., Baltimore, which were destroyed. Loss, $4,000; insurance carried, $5,375.

——The generator of the Corrigan Ice Co.'s plant, at Colmesneil, Tex., exploded September 13, killing J. C. Liggett, proprietor of the Commercial hotel.

——Six empty ice houses, belonging to Wood Bros.' Union Ice Co., Kansas City, Mo., were burned September 9. Loss, $5,000; fully insured; cause, unknown.

——Six large ice houses filled with ice, the property of the Pekin Lake Ice Co., Pekin, Ill., were burned September 11. Loss, $30,000; insurance, $8,000; cause, incendiary.

——On August 27 two large ice houses at Haverhill, Mass., property of the Haverhill Ice Co., collapsed. The houses were fifteen years old, and somewhat dilapidated. Insurance carried, $5,000. The houses will be rebuilt.

——On September 15 the ice factory at Hallettsville, Tex., was burned to the ground. Loss, $6,000; insurance, $2,400; cause, supposed incendiary, the plant having been shut down for six weeks, owing to some difficulty not explained.

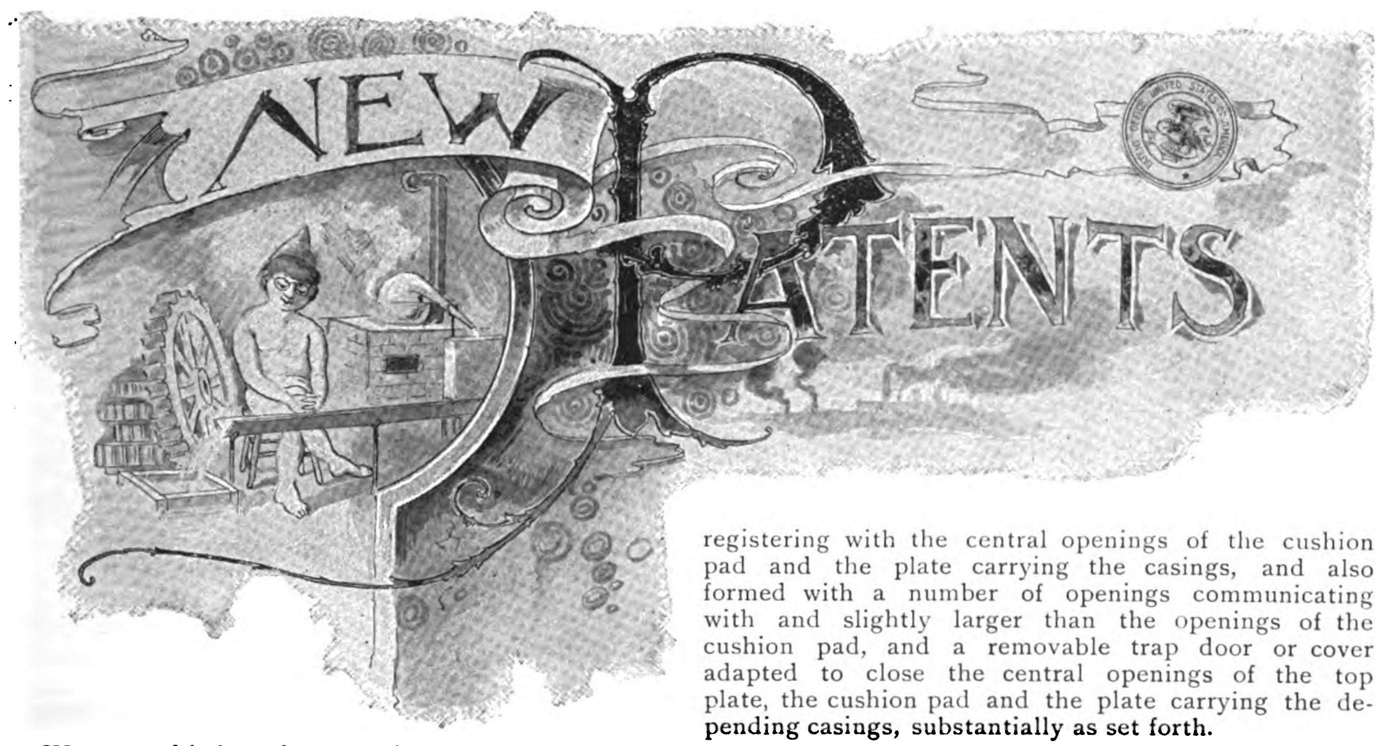
——G. W. Sawin's ice houses at East Watertown were burned September 9, together with 1,600 tons of ice. The ice was owned by J. W. Downing, of Brighton, and the Howard Ice Co. and W. T. Howard, of Watertown. Loss, $6,000; partly insured; cause, incendiary.

——On September 18 fire destroyed the warehouses, cold storage rooms, refrigerators and stock of J. F. Daugherty & Co., and the Hamilton Wine and Beer Co., opposite the city of Keokuk, Iowa. Two of the eight cars were also burned. It is thought the fire was caused by sparks from a passing locomotive. The loss is estimated at $20,000.

——The Hygienic Ice Co. factory, Raleigh, N. C., owned by Henry Bayer & Co., Charleston, S. C., operated by F. K. Keogh and Henry Perry, was burned August 29. Loss, $20,000; insurence, $8,000; cause, unknown. The origin of the fire appears to have been in a room in the second story, in the southwest corner of the building, formerly used as an office, but lately as a place for storing tools. The flames were first seen to burst out of the windows of this room. So far as known there was nothing in that part of the building which could have ignited, and no theory can be furnished as to how the fire started.

——Four ice houses on Wolf lake, near Hammond, Ind., owned by the G. H. Hammond Provision Co., were burned September 13. The houses are grouped about a side track between the Fort Wayne line and the lake shore. A blaze starting in one quickly spread to the adjoining houses, and the four were reduced to heaps of ashes. They stood on a lonely spot several miles from the nearest fire station, and were destroyed before a well organized attempt to save the property could be made. Each one contained a large amount of ice, and was equipped with machinery for shipping and storing. Each house was 350×75 feet in dimensions. They were built some years ago, and were equipped to store the ice needed by the provision company. The loss is not stated.

THIS season's salmon run on Fraser river, B. C., has been larger than ever before. Some of the small tributaries were so choked with fish that the boats were unable to cross. On the 24th of August the run averaged 900 to a boat. Many boats were swamped and one fisherman, Andrew Anderson, owing to an overcargo of fish, was drowned. The only way the fish could be landed was stowing them by thousands in nets behind the boats to the shore. The Fraser river pack amounts to 425,000 cases, and the northern canneries to 123,000 cases, a total for B. C. of 548,000. Should the Alaska pack of salmon reach 500,000 cases salmon will be very cheap this autumn. We have as yet received no advices from the salmon freezing works, but there is no doubt they also have done a large business.

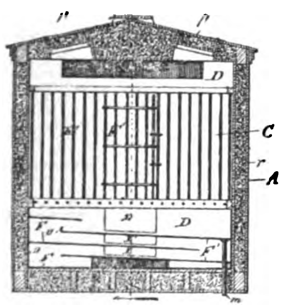


We append below the most important new patents relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for ICE AND REFRIGERATION.

REFRIGERATOR CAR.

No. 502,661. William E. Eastman, Boston, Mass. Filled August 22, 1892. Serial No. 443,763. Patented August 1, 1893. (No model.)

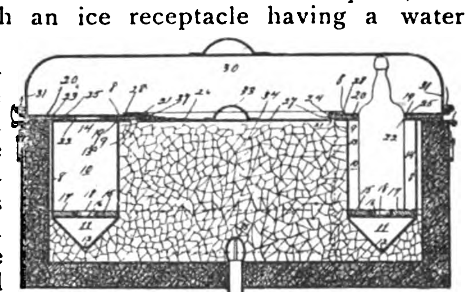
Claim—1. In a refrigerator car, the combination with the merchandise and ice storage chambers *B* and *C* communicating through an opening *o* and separated by a partition *D*, of a circuitous air flue in the base of the chamber *C* formed with the alternating, oppositely inclining shelves *F F*, all located below the ice supply, a drip pipe *m* leading from the upper end of the uppermost shelf *F*, and an outlet *G* in the base of the partition, through which the flue opens into the chamber *B*, substantially as and for the purpose set forth.



WINE COOLER.

No. 502,114. William H. Fay, Kansas City, Mo., assignor of one-half to Frank G. Mitchell, same place. Filed December 22, 1892. Serial No. 456,030. Patented July 25, 1893. (No model.)

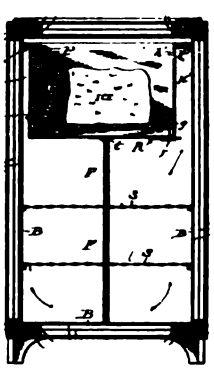
Claim—4. In a cooler for wines and liquors, the combination with an ice receptacle having a water escape tube communicating therewith, of a plate closing the open end of said ice receptacle, casings or sockets depending from said plate into the ice receptacle, and vertical partitions dividing the casings or sockets into separate compartments or chambers, and a cushion pad having a central opening communicating with the opening of the plate, and with a number of smaller openings communicating each with a compartment or chamber of the casings or sockets, and a top plate secured upon the cushion pad, and formed with an opening registering with the central openings of the cushion pad and the plate carrying the casings, and also formed with a number of openings communicating with and slightly larger than the openings of the cushion pad, and a removable trap door or cover adapted to close the central openings of the top plate, the cushion pad and the plate carrying the depending casings, substantially as set forth.



REFRIGERATOR.

No. 500,147. David H. Metcalf and William S. Doy, Battle Creek, Mich. Filed June 27, 1892. Serial No. 438,232. Patented June 27, 1893. (No model.)

Claim.—1. In a rectangular refrigerator, the side, top and bottom walls thereof, each of said walls consisting of a plurality of open rectangular frames, paper partitions secured to said frames, and a metallic covering entirely inclosing said frames and partitions; said walls being assembled and permanently secured together at their contacting surfaces, substantially as described.

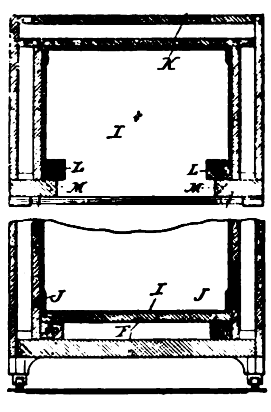


2. In a rectangular refrigerator, the side, top and bottom walls thereof, each of said walls consisting of a plurality of open rectangular frames laid side by side, paper partitions secured to said frames and located between and also on opposite sides of the same, and a metallic covering, entirely inclosing said frames and partitions; said walls being assembled and permanently secured together at their contacting surfaces, substantially as described.

REFRIGERATOR.

No. 501,277. Charles Hurd, Duluth, Minn. Filed February 25, 1893. Serial No. 463,750. Patented July 11, 1893. (No model.)

Claim.—1. The floor of the cooling chamber extending to the front edge of the door opening of the cooling chamber; and the sheet metal lining, covering the entire floor, turned up on three sides of the refrigerator, and extending over and under the front edge of the floor, making a water-tight lining at the bottom of the cooling chamber of the refrigerator, substantially as specified.



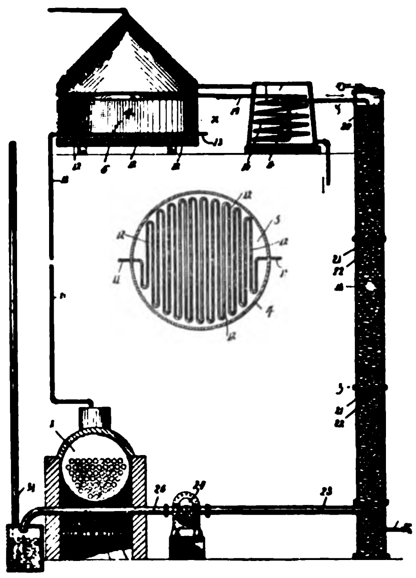
2. The sheet metal lining *I* at the bottom of the cooling chamber of the refrigerator turned upon three sides of the cooling chamber, and extending under the stops on the sides of the door of the refrigerator, and through a scarf in the front pieces at the sides of the door of the refrigerator, and also over the front edge of the floor of the refrigerator to prevent the water from running off of the sides of the lining under and around

the bottom of the door opening of the refrigerator, as specified.

APPARATUS FOR AERATING DISTILLED WATER.

No. 502,408. James E. Thomas and Elisha P. Grow, Bay City, Mich. Filed November 2, 1892. Serial No. 450,737. Patented August 1, 1893. (No model.)

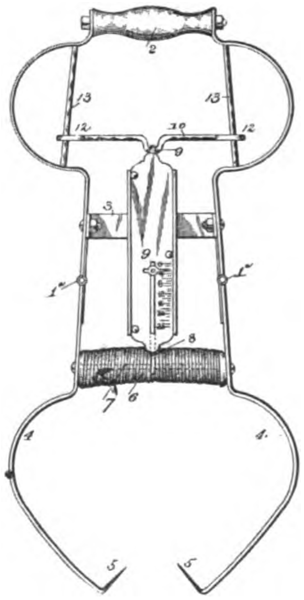
Claim.—1. The combination of the water still, with a hollow vertical cylinder provided with a filling of crushed or disintegrated stone, a pipe leading from the still to the upper portion of said cylinder, an air pipe passing through a furnace for heating the contained air and leading to the bottom of the cylinder, substantially as set forth.



4. The combination of the water still, the long vertical aerator cylinder having a filling of disintegrated or crushed stone, and a pipe for conducting water from the still to the aerator, an air pipe provided with a blower for conducting air to the aerator, and a series of disks depressed toward their center and placed at intervals within the aerator cylinder, and provided with a central opening for deflecting the descending water and the ascending air current from the outer portions of the filling material to the central portion thereof, substantially as described.

COMBINED ICE TONGS AND WEIGHING SCALES.

No. 503,042. Thomas Glynn, Philadelphia, Pa. Filed January 10, 1893. Serial No. 457,910. Patented August 8, 1893. (No model.)



Claim.—The combined ice tongs and spring scales herein described, comprising the arms provided with guide rods, the curved jaws hinged thereto, having spurs at their free ends, the coiled spring connecting said jaws, the spring balance connected with said spring, and the bar embracing said guide rods and connected with the upper end of the spring balance, substantially as and for the purpose specified.

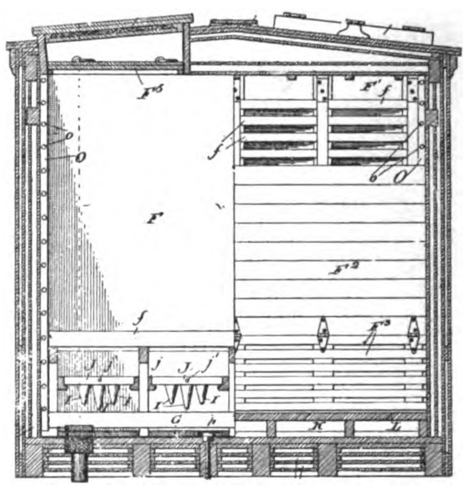
REFRIGERATOR CAR.

No. 503,772. John Player, Topeka, Kan. Filed February 2, 1893. Serial No. 460,712. Patented August 22, 1893. (No model.)

Claim.—1. In a refrigerator car, the combination of an ice box, a stationary pan at the floor of the car beneath such ice box, and a trough rotatably supported at a point beneath such pan and ice box, substantially as described.

7. In a refrigerator car, the combination of an elevated ice box communicating with the car, a duct beneath the floor communicating with the space beneath the ice box and the space within the car, and a series of troughs placed between the bottom of the ice box and the floor of the car to maintain a body of cold water at this point, whereby the air passing into the duct is brought into contact with the troughs, substantially as described.

8. In a refrigerator car, the combination of an ice box, a stationary frame placed at a point beneath the bottom of this box, another frame rotatably mounted in

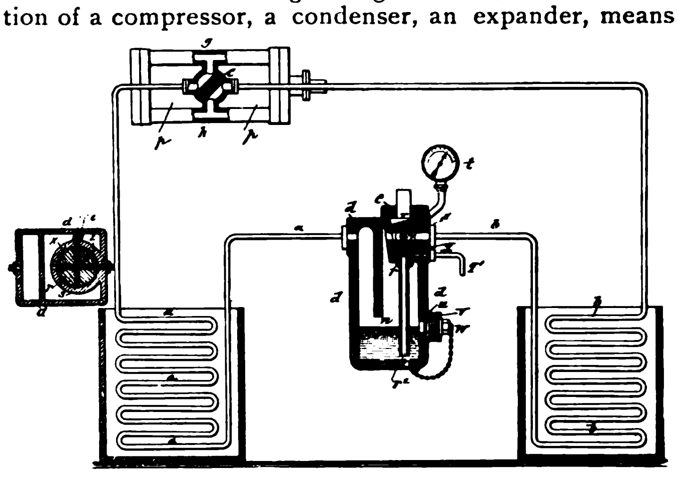


the stationary frame, and a series of communicating troughs supported in the rotating frame, substantially as described.

REFRIGERATING AND ICE MAKING MACHINERY.

No. 504,091. Paul I. Schmaltz, Humburg, Germany. Filed November 14, 1891. Serial No. 411,863. Patented August 29, 1893. (No model.)

Claim.—1. In a refrigerating machine, the combination of a compressor, a condenser, an expander, means



for reversing the course of the refrigerating medium whereby it is condensed in the expander, an oil separating chamber connected with the condenser, and a valve connecting said oil separating chamber with the expander whereby when said refrigerating medium is condensed in said expander and said valve is opened, a sudden expansion takes place from the expander to the oil separating chamber, substantially as set forth.

4. An oil-separating chamber for refrigerating machines provided with a partition *n*, an expansion valve or stop cock, *e*, the spigot of which has a downwardly extending tube *r′* and a lateral discharge hole *q*, a discharge pipe, *q′*, and a glass gage *u*, substantially as set forth.

——The refrigerator factories at Grand Rapids, Mich., which shut down during the money scare, have resumed operations.

——The Orange (Tex.) Ice, Light and Water Works Co. have issued $10,000 of first mortgage 8 per cent bonds, interest payable semi-annually, for the purpose of making improvements in the plant.

——The Boston Ice Co., Boston, Mass., has filed a petition asking for leave to go into voluntary liquidation and to wind up its affairs. Objection must be filed with the court not later than October 2.

——W. S. Avard, who has been agent for the lessee of the Frigid Ice Factory, Joplin, Mo., shut the machinery down on August 1, owing to dull business. He has turned the plant over to the lessee, and the Frigid Ice Co., who have been handling the ice from this machine, closed their season September 1, the trade being so dull since the cool snap that it will not warrant them in shipping again.

ICE AND REFRIGERATION ILLUSTRATED

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

VOL. V. NO. 5. CHICAGO : NEW YORK : NOVEMBER : 1893. $2.00 PER ANNUM.

[*Original in* ICE AND REFRIGERATION.]

GASES IN ICE MACHINES.

FORMATION OF GASES IN ABSORPTION ICE MAKING MACHINES—WHAT IS THE NATURE AND CAUSE OF THE PHENOMENON—AN IMPORTANT QUERY ANSWERED.

WE, as manufacturers of aqua and anhydrous ammonia, are frequently appealed to for an explanation of the gases that are continually forming in absorption machines. After making a chemical analysis of the ammonia before and after entering the machine, we find no hydrocarbons, nor any properties that would tend to produce these gases. In reading up all your journals for the past two years, we can find no mention made of the facts other than the one made by Mr. Richmond in the June, 1892, issue, page 439, of ICE AND REFRIGERATION, which still awaits Mr. Starr's explanation, and that I have been unable to find, unless it is given in July issue of the same year, which I have been unable to get here. However, if you will endeavor to get an explanation of these facts, you will not only enlighten the manufacturers of ammonia, but all the owners of absorption machines, who are constantly being annoyed with the trouble, and which, by the way, may sooner or later cause an explosion. J. R. D.

A SUGGESTION MERELY.

As to the nature and formation of the gases occurring in ammonia refrigerating machines, noted above, we can only repeat the conjectures which have been made on this subject heretofore, as no chemical analysis has been made of them as yet. The proposition that they consist largely of hydrogen seems to be the most acceptable, and as to whether this be due to a decomposition of the water or of the ammonia we incline to the belief that more likely it is due to the latter. We do not think, however, that electrical currents are responsible for the formation of the gases in any case. It is doubtless a case of chemical activity, and if electricity is developed at all it must be considered as the consequence and not as the cause of the chemical activity set up. Moreover, if a separation of the so-called electric fluids should take place, their reunion would follow as an almost immediate consequence, the whole surroundings being composed of such excellent conducting material as is actually the case. It is a well established fact that iron decomposes ammonia as well as water at a temperature much below red heat, combining with the nitrogen in the one and with oxygen in the second case. In both cases hydrogen gas is liberated. It is also known that water will be decomposed by iron at a much lower temperature under certain favorable circumstances, and doubtless similar conditions prevail in the case of ammonia, although we are not prepared at present to define them in detail. The formation of the gases and the corrosion of iron pipes and bolts in refrigeration machines seem to be phenomena closely related to each other; for while the nitrogen of the ammonia and the oxygen of the water, or either of them, combine with the iron of the pipes and bolts, thus corroding them, the hydrogen thus liberated forms the incondensable portion of the volatile matter present in the system. It does not appear to us necessary to assume an abnormal composition of the ammonia in order to account for the phenomenon. The circumstances under which it occurs favor the supposition that changes in the temperature of the coils and in the pressure are the inciting factors. It stands to reason also that one iron, on account of difference in composition, is more liable to effect the said decomposition than another. These are the most probable conjectures which we are able to present on the subject. Doubtless it will not be long before one of the able chemists employed by some progressive ice machine manufacturers to investigate matters of this kind will take the subject in hand and give us not only theories, but the actual composition of the permanent gases and of the solid matter due to the corrosion of the iron as well. This is the only way in which a conclusive explanation of the subject can be reached.

MR. JOHN E. STARR'S REMARKS.

I have given some attention to this matter of insoluble gases often found in absorption machines, as mentioned in the above letter, and while not possessing a sufficient degree of chemical lore to attempt a full explanation of the phenomena, I may be able to throw some light on the subject. First, I think I am in a position to say that all the troubles arising from the presence of the insoluble gases should not in every case be laid at the door of the manufacturer of aqua ammonia.

There is no doubt that the presence of such gases is a positive detriment to the proper and economical working of the machine. In a condenser, properly proportioned for the work to be accomplished, the insoluble gas occupies a considerable portion of the space which should be devoted to holding the condensing ammonia gas, and therefore deprives the machine of effective condensing surface. I have noticed as much as 50 per cent

of the condenser thus thrown out of use, reducing its capacity f om that of a 50-ton condenser to one of 25-ton capacity; the result being—if fifty tons of work is accomplished—a greatly increased condensing pressure (at the expense of coal) or the necessity of a greatly increased water supply on account of the reduction of heat-exchanging surface.

In the absorber, or low pressure end of the machine, the pressure of insoluble gases is equally detrimental. These gases lodge in the top, or waste gas spaces, of the absorber, and cause an over-pressure by their mere bodily presence (akin to a hydraulic pressure), so raising the back pressure. The result is that the aqua, instead of having the pressure due simply to its strength and temperature, has some higher pressure, depending on the quantity of insoluble gas occupying the space over it. This results in a lower strength at the same back pressure, or the necessity of using more water or more surface to maintain the strength of the aqua to the standard on which the machine is designed.

I have endeavored to point out in my notes on the absorption machine, published in ICE AND REFRIGERATION, the relation of strength of solution, "back pressure," and economy; and any one conversant with these relations will understand the bad effects of a pressure over that due to the strength and temperature of the solution. I sketch these features merely to show the importance of the subject, which is greater than the mere remote fear of an explosion, such as is suggested by the writer of the above letter.

It cannot be doubted that oftentimes the aqua ammonia of commerce contains more or less of the lighter hydrocarbons when made from "gas liquor." These hydrocarbons confessedly exist in the original crude liquor, and it depends on the skill and care with which the aqua ammonia is prepared whether the "26° aqua" sold to the ice machine operator contains hydrocarbons or other gases which will work to the disadvantage of the machine. These objectionable gases are supposed to be removed, and can be nearly all removed by proper purifiers in the process of the production of aqua ammonia. If carelessness or greed cause the manufacturer to run his purifiers too long without recharging, and they reach a point of saturation beyond which they have but feeble power to interrupt the impurities, the result will be a product unfit to be placed in a refrigerating machine as a working fluid. Once in a while every operator will get a batch of this bad ammonia. The most careful and honest manufacturers are liable to make a slip and turn it out. It can usually be detected at once by an experienced nose by reason of its "rotten" smell, and should be rejected.

I am inclined to think, however, that unless the batch is a particularly bad one, the effect on the work of the machine will not be greatly detrimental. It depends somewhat on the form of the condenser and the size of the gas space on the absorption side of the machine. The fact that the gas is in solution when the aqua is received, would tend to show that it should be soluble to some extent in the absorber, and the bad effects would be restricted perhaps to the condenser. Still it cannot be denied that the presence of impurities originally in the aqua is often a source of trouble and expense to the ice machine man. I have even found sesquicarbonate of ammonia (the volatile salt commonly known as "hartshorn") in sufficient quantities to stop up an expansion coil; and have run across bad batches of ammonia sufficient to seriously affect the pressures and economics of a new machine where the presence of bad gas could not be accounted for on any other theory than that of impurities in the aqua as it came from the manufacturer.

The strikingly apparent presence of insoluble and inflammable gas in various parts of the machine, however, cannot be charged in every case, and perhaps not in the majority of cases, to the manufacturer of aqua ammonia. I will state briefly the facts that lead me to this conclusion, and cite a typical case of several that have come to my notice. A long time ago my attention was called to a machine that was manifestly "out of line." The condenser was ample for the work to be done, the water supply in proper amount, and the absorber of fair design and sufficient surface. The work of the machine was far below its previous output; the condensing pressures were entirely out of reason, and the back pressure too high for the surface and water used, and the obtainable strength of solution too low; the range of temperature of the cooling water was far too small on both condenser and absorber. An examination of the condenser showed that the upper portion (fully 50 per cent of the total surface) was stone-cold, and the water for half way down was not raised appreciably in temperature. The absorber showed ten to fifteen pounds above the pressure due to the strength and temperature of the solution. The immediate diagnosis was "bad gas"; prescription, a violent "purge." Quantities of what absorption machine engineers call "rotten gas," or "marsh gas," were drawn from the condenser and absorber, and the bad symptoms began to disappear. I caused a careful analysis of this insoluble gas to be made, and found it to be not a hydrocarbon, but nearly pure hydrogen, mixed a little with air. The mixture was somewhat explosive. The enormous quantities of the hydrogen and some knowledge of the manufacture of aqua ammonia positively precluded the idea that it was originally contained in the aqua. There was but a trace of the lighter hydrocarbons.

Where, then, did the hydrogen come from? The explanation came later. A short time after the discovery of the hydrogen, one of the coils in the still of the same machine was found to be leaky. The coil was taken out and found to be deeply pitted, and here and there eaten through. It was entirely covered with a thick scale, more or less adherent. Evidently oxidation of coil had taken place to a large extent. An examination of specimens of the scale determined the percentage of oxygen in it to be 26.9 per cent. The theoretical percentage for magnetic oxide of iron being 27.6 per cent, the approximation was amply sufficient to determine the scale to be magnetic oxide of iron, Fe_3O_4. As this oxide is the chief product of the oxidation of iron at a high temperature in aqueous vapor, we have a clue to the appearance of the hydrogen. The aqua ammonia, already highly heated in the exchanger, comes in contact with the steam coils; a portion of the water (H_2O) carrying the ammonia decomposes, the oxygen uniting with the iron to form the magnetic oxide; the hydrogen is set free, and rises with ammonia gas to the condenser, where much of it lodges, to the sorrow of the engineer. Some of it is carried on by the liquid ammonia into the expansion coils, and

from thence to the absorber. As hydrogen as a free gas is only slightly soluble in water, it rises to the top of the absorber and soon accumulates in sufficient quantities to affect the back pressure. Just why a decomposition of the water occurs in the still, and why it does not occur in all stills, is a chemist's problem. That it does occur, I think is amply proven by the invariable presence of magnetic oxide on the steam coils whenever large quantities of hydrogen are found in other parts of the machine. I have run across the phenomena a number of times; and am convinced that in by far the largest number of cases where trouble is had with insoluble gas, the gas will be found to be hydrogen, and that the coils in the still will be oxidized. I have found cases where, in the same still, one coil was attacked and another one next to it similarly exposed was not touched. I know of cases where, in the same still room, containing two or more stills working at the same pressure and steam heat, one still showed oxidation and the others none.

It is suggested that an electrical action is set up in some stills, assisted, perhaps, by the chemical constitution of the particular iron in the coil, the high heat and the presence of ammonia, and that the water is split up by electrolysis. There are grounds for this belief, and it would help explain why the phenomenon is not a universal occurrence in absorption machines instead of an occasional one.

No two pieces of iron are exactly alike in chemical composition, and it might be said that this would account for the fact that all still coils are not affected alike. Whatever may be the cause of these chemical reactions, I deem the evidence at hand amply sufficient to prove the connection between oxidation in the still and hydrogen gas in other parts of the machine. This oxidation may take place only in a limited degree, not enough to seriously damage the coils; but the production of a comparatively small amount of magnetic oxide would set free enough hydrogen to seriously affect the pressures and economy of the machine. If operators of absorption machines find themselves troubled with "bad gas," my advice is to follow the usual practice of "burning off"; but before blaming the manufacturer, find out just what the gas is. If they are not familiar with the characteristic smell and pale yellow color of the flame of hydrogen, an analysis of the gas by the nearest chemist can be cheaply made. If it is hydrogen, and comes in large quantities and keeps coming, look to the coils in the still. So far as I have been able to discover, the reaction referred to only takes place on the still coils and not in other parts of the machine. A high degree of heat seems also a necessary condition. The manner in which the heat is applied to the aqua, *i. e.*, the position of the coils, has also much to do with it; but this portion of the subject trenches so much on manufacturers' practice in existing machines as to make it a delicate matter to discuss in these columns.

A SUGGESTION BY MR. GEO. RICHMOND.

In reply to the above inquiry, I am sorry to be unable to throw any light on the subject of the gases found in absorption machines. Inclosed you will find a clipping, believed to have been taken from the *Scientific American*, in which some explanation is offered, which can hardly be said, however, to add very much to our knowledge.

It does not seem a very difficult problem for the chemist to solve, if a real desire exists to get at the bottom of this phenomenon. What is wanted is a complete statement of all the facts in each case of the occurrence of the gases: their constitution, the quality of ammonia used, whether "aqua" or "anhydrous," and, if the latter, whether made from "gas liquor" or sulphate. Probably such information could be obtained only from the users of the machines in question, investigations by manufacturers of ammonia being necessarily handicapped by commercial considerations. Even though the origin and cause of the gases should escape detection, practical information of value to users would be obtained.

The suggestions in the letter of mine referred to were pure speculations, devoid of any scientific value, and offered in the hope of eliciting some real information on the subject. In the absence of correct analyses of the gases we have nothing but such conjectures to fall back on.

The clipping referred to above is as follows:

AN UNKNOWN GAS.—Passing Stratton ice works a short time ago, a reporter saw Mr. Ware, one of the proprietors, on top of the huge ammonia machines, intently watching a long jet of flame which was consuming the gas as it issued from a half inch vent pipe in the top of the machine. Inquiring what kind of light it was, the reporter was informed by Mr. Ware that he did not know anything further than that it was gas which, by some mysterious process, is generated in the "absorber," during the process of ice making with ammonia, and which often creates such a back pressure as to necessitate prompt attention in giving it vent to relieve the machine. The gas burns with a dull greenish flame, but is quite combustible; and while the matter was being discussed by them, the supply was exhausted and the flame went out with a sputter. Mr. Ware then said that there would be no more trouble with it for twenty-four hours, when another accumulation would take place. He further said that no chemist had as yet been able to explain the nature of the gas, or why it is generated in this manner.—*Pensacola News.*

The mystery of the above is probably not very deep. The greenish color of the flame at once betrays its ammoniacal nature or the presence of some ammoniacal compound. Under the conditions of pressure, presence of organic matter from lubrication, etc., it is easy to conceive that a combustible gas could be generated which would contain enough ammonia to give a green color to the flame. Examination by a competent chemist would soon determine the composition of the gas.—*Scientific American.*

SONGS OF THE KICKER.

HOUSEKEEPER—"Is this natural ice or the manufactured?"

ICE MAN—"That's genuine, nat'ral ice, ma'am. It ain't any o' y'r chunks of water stuck together with glue."

SERVANT—"Which company do you get your ice from, ma'am?"

MISTRESS (sighing)—"The Independent Ice Company."

SERVANT—"Yes, ma'am; but which independent ice company?"

"MARY, didn't we get fifty pounds of ice this morning?" said a West End lady.

"Yes, mum," responded the girl.

"I don't see it in the ice chest."

"No, mum; I dropped it and it fell through a knot hole in the kitchen floor. I am very sorry, mum."

——J. E. Macuen is to put in a new engine at his ice houses at Wilford, Mass., which will be used during the harvesting of his ice crop the coming winter.

——The Independent Ice Co., Gardiner, Me., made their last shipment about the middle of the month. This company has shipped about 50,000 tons and will carry over 20,000 tons.

——W. F. Tay, Barre, Mass., is building a new ice house which will be 32×54, with fourteen-foot posts, will contain over 1,700 feet of flooring, and will be of sufficient capacity for the storage of 5,000 tons of ice.

[...inted from CHEMICAL NEWS.]

REFRIGERATION IN CHEMICAL SYNTHESIS.

...HODS OF UTILIZING EXTREMELY LOW TEMPERATURES—THE EIGHT LAWS OBSERVED IN EXPERIMENTAL VERIFICATIONS.

By RAOUL PICTET.

IN order to develop from the totality of facts explained in former papers a practical method of utilizing low temperatures in chemical syntheses, it will be useful to recall the partial laws which we have already seen.

The fundamental hypothesis which has guided us and the experimental verifications have enabled us to establish eight laws:

1. At very low temperatures, below —130°, no chemical reaction takes place, whatever substances are present.

2. All chemical reactions are manifested spontaneously at a certain temperature and under a certain pressure exerted under the constituents; this is the temperature limit.

3. The same reactions may be obtained below the temperature limit if we apply auxiliary energy by the use of electric currents or discharges.

4. Exothermic reactions always present two phases: in the former we retain a control of the temperatures if we can remove from the combining bodies, by radiation, as much heat as is produced at the same moment by the simultaneous effect of the affinities of the extraneous energies introduced into the substances. In the second phase the temperature rises suddenly until the reaction takes place above the temperature limit.

The first phase is the reaction limit. The second phase is the reaction in mass.

5. Endothermic reactions are always limit reactions.

6. The dissociation of the products obtained by exothermic reactions corresponds to the laws of endothermic combinations, and reciprocally.

7. The temperature limit of chemical reactions is not in a known simple relation with the apparent energy of the phenomenon. On the contrary, the quantities of heat liberated seem to class the ascending order of the temperature limit, especially in one and the same family of substances.

8. The electric spark and current seem to be the best media for supplying extraneous energy to limited chemical reactions.

With these eight partial laws we may establish a complete scientific programme for the discovery of a general method of chemical synthesis.

We begin by bringing in contact the simple bodies, and defining experimentally the laws which govern their combinations, the relations between their temperatures, the pressures, and the quantities of heat to be supplied in limited reactions.

As the first series of observations must, on principle, give precise numerical values, we must never allow reactions in mass to interfere, as they disturb and modify the thermic conditions of the phenomenon. This condition, *sine qua non*, indicates at once the plan of operations to be followed. The chemist must have at command a powerful refrigeratory apparatus, by which he can at least reach temperatures of —130° to —150°, so as to paralyze all chemical reaction. Substances thus cooled are certainly below all the temperature limits.

The refrigerating tank must have a temperature which can be regulated at will from —130° to the ordinary temperature.

A powerful induction coil yields sparks which must be made to strike, by means of insulated conductors, through the substances to be combined, in the refrigerated inclosure.

When the reaction commences, the heat produced each moment by the weight of the compounds obtained must be withdrawn by radiation, so that the temperature at which the reaction is produced may be kept constant.

The quantities of energy represented by the electric current in amperes and volts are equivalent to the endothermic phase of the reaction. The quantities of heat lost by radiation measure the exothermic phase.

The calorimetric measure effected in the refrigeratory enables us to know directly the effect of radiation for all the differences of temperature.

We shall on this principle constitute the first rational dynamic table in chemistry, by studying all the simple bodies two by two, three by three, etc. By combining by the same methods, and with the same appliances, the binary bodies with the simple bodies, we obtain the second dynamic table. Next we pass to the ternary substances.

The successive experiments will discover the laws which govern the phenomena, and will in so far facilitate the knowledge of the utilization of the dynamic tables. The line of the greatest chemical declination of all bodies will thus be determined experimentally.

Chemical reactions will be defined in a manner as precise and certain as the fall of a body on an inclined plane by a single track without ambiguity. We shall know beforehand, for any reaction which we may wish to produce, all the conditions to be fulfilled so as to obtain only a single effect, *e. g.*, the fixation of a new element upon a given primitive nucleus.

The track will be known, and the result certain. Under this form we see the possibility of forming rationally by direct synthesis all the substances in nature.

It is probable that along with the electric spark we may utilize other sources of auxiliary energy, *e. g.*, the collateral chemical reactions produced in the series of substances studied, and which will yield a known number of calories. The subject of this immense research is scarcely touched upon; we have confined ourselves to lay down its principal lines. The present experimental results give a preliminary sanction to this programme.

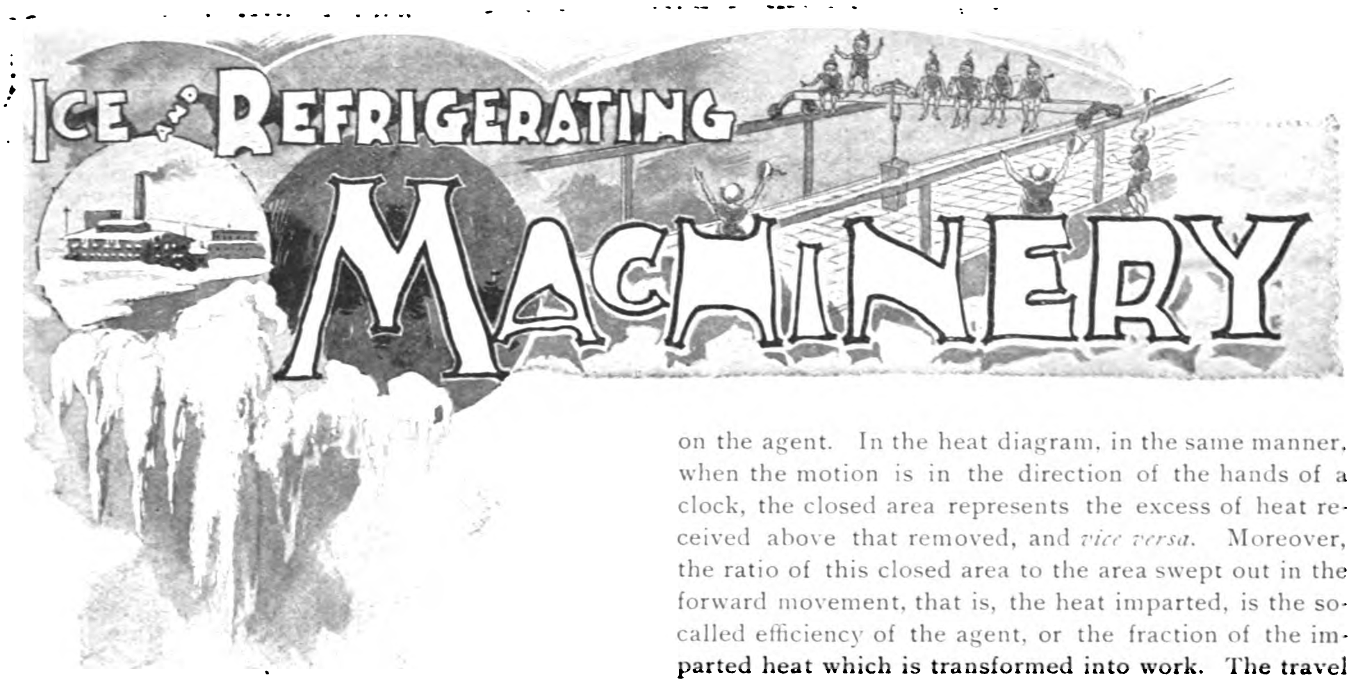
In concluding the exposition of these general views on the phenomena of ponderable matter, we see that the same equations of motion may represent as a simple function of distances:

1. All astronomy and the phenomena of gravitation, the distance of bodies which attract each other, passing from infinity to distances where the action of the ether manifests itself to modify the law of Newton.

2. All cohesion where the totality of the physical phenomena of changes of state linked to calorific phenomena where the distances of the attracting bodies pass from the limits of gravitation to the distance of bodies refrigerated to the absolute zero.

3. All chemistry, phenomena of motion, when the distance of the attracting bodies is smaller than that observed at the absolute zero.

The equations or the movement of matter permit us thus to reduce these three sciences to a single formula, the numerical terms of which are not yet known, but from which we may logically deduce every observable phenomenon.



(Written for Ice and Refrigeration.)

THE WORK DIAGRAM AND THE HEAT DIAGRAM.*

GRAPHICAL REPRESENTATION OF THE PROPERTIES OF AMMONIA, AND SOLUTION OF THE PROBLEMS ON COMPRESSION MACHINE.

By Geo. Richmond, M. E.

WE have seen that when the pencil of an ordinary indicator traces out a curve measuring the work done, another indicator may be conceived to be geared with it in such a manner that its pencil will trace out a diagram measuring the heat supplied or removed from the agent. In consequence of this gearing, for every point on the work diagram there must be a corresponding point on the heat diagram, and the study of the theory of heat and properties of the agents really resolves itself into determining the nature of this gearing, which when found enables us to complete the two diagrams, and puts us into possession of all that it is necessary to know in order to treat nearly every question or problem which may arise. When the pressure ordinate travels forward to the right (Fig. 1), the area it sweeps out represents work done by the agent; when it travels to the left the area represents the work done on the agent. In the heat diagram, when the temperature arm or ordinate travels to the right, the area swept out represents heat imparted to the agent; and when it travels to the left, it sweeps out an area representing heat removed.

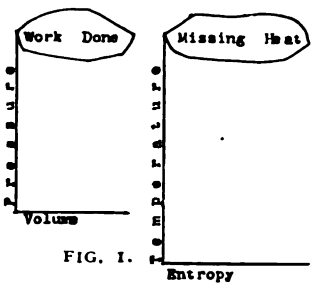


FIG. 1.

The pressure and temperature arms as they progress do not by any means sweep out equal areas; but after traveling in such a manner as to return to the starting point, the closed areas thus formed are equal. We may regard each of these closed curves as roughly representing a clock face; and it is easily seen that when the motion around the curve is in the direction of the movement of the hands, the area of the closed curve on the work diagram represents the net work done by the agent, or the excess of work done by the agent over that done on the agent. In the heat diagram, in the same manner, when the motion is in the direction of the hands of a clock, the closed area represents the excess of heat received above that removed, and *vice versa*. Moreover, the ratio of this closed area to the area swept out in the forward movement, that is, the heat imparted, is the so-called efficiency of the agent, or the fraction of the imparted heat which is transformed into work. The travel of the pressure arm is the measure of the change of volume. If it travels to the right, the volume is increased and the agent does work; if it travels to the left, the volume is diminished and work is done on the agent to diminish that volume. The travel of the temperature arm is called entropy. Increase of entropy marks the addition of heat to the body; the decrease of entropy, or travel to the left, marks the removal of heat. When the volume remains constant, the pressure may change, but no work is done when the entropy remains constant; the temperature may change, but no heat is imparted or removed. It is seen that entropy when thus represented is a very easily understood quantity, having the same relation in the heat diagram that volume has in the work diagram. Nevertheless a certain amount of mystery is, in many minds, associated with the idea, and the reader may use the word travel instead, if he prefers.

It might at first sight seem that the equality of the two closed areas follows simply from the doctrine of the conservation of energy, for the missing heat represents energy which cannot have been destroyed, and the only equivalent we have of it is the work done. A little consideration, however, will show that this conclusion is unwarranted. When heat is applied to a body it may be used up in three ways: *First*, it may make the body hotter, as when iron or water is heated; *second*, it may do internal work, as when a liquid is evaporated or a solid melted; and, *third*, it may do outer work by expansion against a resistance. The outer work we can usually measure, but the first two items are difficult to separate absolutely, and the sum of the two taken together is called the energy of the body; so that when a body is heated we may say that the heat is divided into two parts, one of which increases the energy of the body, and the other is transformed into work. When a body is made to run in a closed circuit by the addition and removal of heat, representing by the subscript $_1$ the heat added on the forward motion, and by the subscript $_2$ the heat added on the return motion, we have:

$$H_1 = E_1 + W_1 \quad . \quad . \quad . \quad . \quad (1)$$

and

$$H_2 = E_2 + W_2 \quad . \quad . \quad . \quad . \quad (2)$$

Subtracting the second equation from the first, the difference between H_1 and H_2 evidently represents the

closed area in question, and it will only represent the net work $W_1 - W_2$ on condition that E_1 is equal to E_2: in other words, the energy imparted by the addition of heat is the same as the energy removed in coming back to the initial position. This important fact, which alone enables [illegible] ·t the closed heat area is equal to the outer [illegible] nown as the first principle of heat. The [illegible] nciple is involved in the choice of the scale on which the temperature arm is made. So far as the first principle is concerned it does not matter what temperature scale is used, but when we wish to study the relation of the closed heat area to the total heat imparted this matter becomes important. If the agent experimented upon were a perfect gas, we should be led naturally to the use of the temperature scale having its zero about 460° below the zero F., and it may be shown that when treating any other agent the same scale must be used or otherwise we should be led into the contradiction of some statement which is regarded as axiomatic, such, for example, as that of Clausius or Thomson already noticed.

These two principles, representing the sum of what has been acquired in the science of heat, enable us to establish quite a number of relations between the quantities involved in the two diagrams; but in addition to these, to actually draw them point by point, it is necessary to have some further relations between the physical properties of the agent used.

In the case of a perfect gas, the well known relation:

$$B V = R T \quad . \quad . \quad . \quad . \quad (3)$$

is sufficient when taken in connection with the two principles above named to complete the gearing between the two indicators. In the case of an imperfect gas or vapor, we can only obtain the relations covering a limited area. All such relations in the present state of the science are ultimately based on experiment and observation, although the different properties figuring in the table are not independent one of the other. Fig. 2 shows in a diagrammatic form the properties of ammonia. The temperature scale to the left is the ordinary Fahrenheit scale, and that to the right is the scale of absolute temperature. The P curve, which is the fundamental curve and the one usually obtained by direct observation, is constructed from Prof. Wood's table (page 92) of the relations between temperature and pressure, and the V curve is constructed from the same table to represent the relations between volume and temperature. The A and B curves are constructed from the table at the end of this article, and their exact significance will be understood from the preceding article of last month. In the table the distance which the temperature arm will travel for each five degrees rise in temperature is given in the column marked A. Thus the travel when the temperature is raised from —40 to 100 is .2877. The width from the A to the B curve at any temperature is given in the column marked $A\ B$. For convenience the travel as the B curve is traced is given in the column marked B. Thus under the same circumstances the width B in Fig. 3 is .2093. It is seen that in tracing the curve B, the temperature arm travels backward so that B is really negative, although in many problems its numerical value only comes into question.

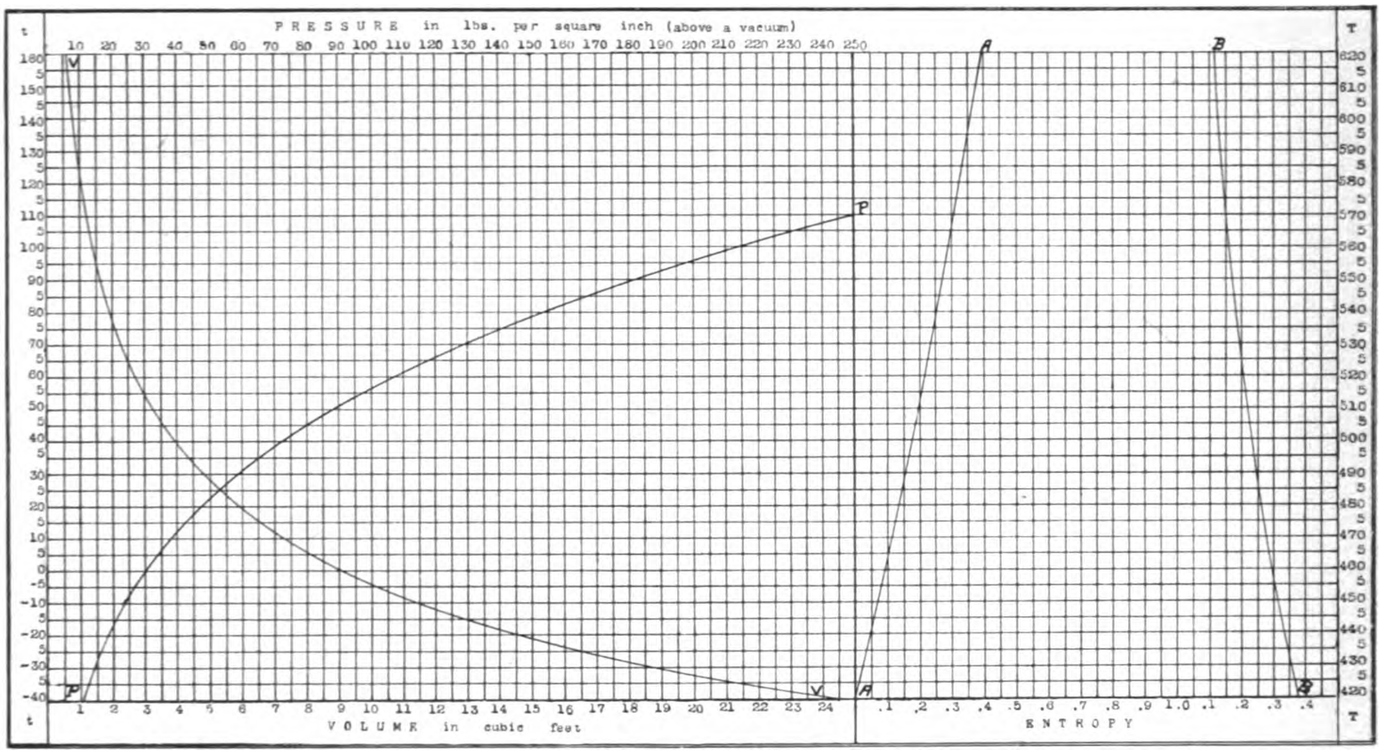


FIG. 2.

It would be a useful exercise for the reader to make this diagram on a larger scale, say a millimeter scale, on which one pound is represented by a millimeter, one cubic foot by a centimeter, and one unit of entropy by a decimeter. This would give a diagram rather more than twice as large as Fig. 2, and would take the place of the tables, with the advantage that we could read quantities directly from the diagram for intermediate values between those of the tables without calculation. From Fig. 2, even, all the properties may be read off with sufficient accuracy for practical purposes, and every problem which can occur in the compression machine can be solved by direct measurement.

For example, the pressure is usually the best known quantity, for which case the tables are not convenient; but from the diagram we can at once obtain with sufficient approximation the other properties. Suppose that the pressure in the compressor is forty-five pounds or

sixty absolute. We draw a line Fig. 3 from 60 on the pressure scale to meet the pressure curve at the point a, and through that point we draw a horizontal line right across the diagram. All the other properties of ammonia at this pressure can now be determined. The line through a cuts the temperature at about 32°, so that the temperature of ammonia at sixty pounds pressure is 32°. The length of the line bc is the volume of a pound of

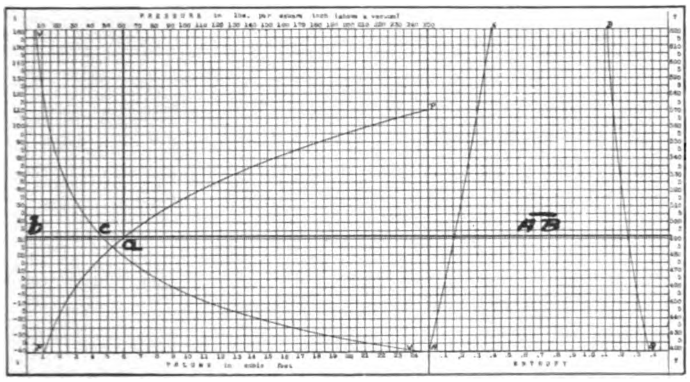


FIG. 3.

ammonia at the same temperature, and can be read off as about 4.65. The density or weight of a cubic foot of ammonia at 60° is

$$\frac{1}{bc} = \frac{1}{4.65} \textit{ pounds.}$$

The length of this horizontal line cut off between the curves A and B (or AB) multiplied by the absolute temperature, namely, 492, gives the latent heat.

If the temperature is given to find the other properties, the manner of operating is sufficiently obvious. Suppose we desire to know the pressure of ammonia at 32°. We draw a horizontal line through 32, and it strikes the P curve at 60, which is the pressure, and the V curve at 4.65, which is the volume. It is not necessary to actually draw the lines on the diagram, for the eye can be run along or a ruler laid across. The reason why every problem relating to the compression machine can be worked out graphically on this diagram will be shown hereafter, and may be briefly described now. We suppose the condenser temperature to be 80° and the refrigerator temperature 15°, and commence by drawing horizontal lines through the diagram at these temperatures. In future we shall mark the condenser temperature T_1 and the refrigerator T_2, writing θ for the difference or the range of temperature, and the corresponding distances between A and B curves $\overline{AB}_1$ and $\overline{AB}_2$ respectively. From the extremities of $\overline{AB}_1$ drop perpendiculars, which will cut off from $\overline{AB}_2$ the portions marked L and B. The value of these latter can be read off from the diagram or be obtained from the table, and is the difference of the value of A for 80° and 15°; B likewise may be obtained from the table, being the difference between the value of B at 80° and 15°.

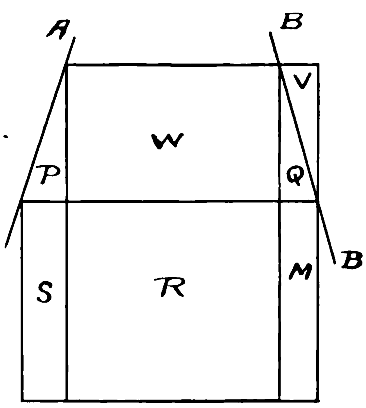


FIG. 4.

We can now consider the different cycles, reproducing the heat diagram for convenience in Fig. 4. This diagram is divided into a number of parts, the area of each of which can beeasily calculated, since they are rectangles of known sides, with the exception of the two triangles P and Q. As to these, we may treat the curvilinear sides as straight lines with very little error, and the area of each is then half the product of the base by the height.

We may commence by tabulating the values of the various lines as determined by actual measurement or from the table.

$$\overline{AB}_1 = 9353 \quad a = .1283 \quad T = 540$$
$$\overline{AB}_2 = 1.15 \quad B = .0864 \quad T_2 = 475$$
$$P = \tfrac{1}{2} L \theta = 4.17 \qquad \theta = 65$$
$$Q = \tfrac{1}{2} B \theta = 2.81.$$

Then the work done in the various cycles is as follows:

WORK DONE. (1 LB. NH_3).

Carnot (expansion cylinder)........	$W = \theta \overline{AB}_1$	$= 60.59$
Linde (wet compression)..........	$W + P$	$= 64.76$
Dry compression..................	$W + (Q + V) + 1\tfrac{1}{2} P$	$= 71.67$
Ammonia Jacketed.................	$P + W + Q$	$= 67.57$

REFRIGERATION OBTAINED.

Carnot............................	$R = \overline{AB}_1 T_2$	$= 444.22$
Linde..............................	$R - P = \overline{M}$	$= 440.05$
Dry compression..................	$R + M - P$	$= 483.12$
Jacketed...........................	$R - P - Q$	$= 437.24$

To apply these results to practical calculation, we need to know the total volume swept out by the compressor in twenty-four hours. Dividing this by the volume of one pound of ammonia at the refrigerator temperature, we obtain the number of pounds of ammonia passed through per day. The work done is expressed above in units of work, each of which is 778 foot-pounds.

ENTROPY TABLE FOR AMMONIA.

t	T	$\overline{AB}$	A	B
—40	420	1.3802	.0000	.0000
—35	425	1.3569	.0118	.0115
—30	430	1.3343	.0235	0224
—25	435	1.3119	.0351	.0332
—20	440	1.2902	.0465	.04[illegible]5
—15	445	1.2689	.0578	.0535
—10	450	1.2481	.0690	.0631
— 5	455	1.2276	.0800	.0726
0	460	1.2076	.0910	.0[illegible]16
+ 5	465	1.1880	.1018	.09[illegible]4
10	470	1.1688	.1125	.0989
15	475	1.1500	.1230	.1072
20	480	1.1315	.1335	.1152
25	485	1.1134	.1439	.1229
30	490	1.0957	.1541	.1304
35	495	1.0783	.1643	.1376
40	500	1.0613	.1743	.1446
45	505	1.0445	.1843	.1514
50	510	1.0280	.1941	.1581
55	515	1.0118	.2039	.1645
60	520	.9959	.2136	.1707
65	525	.9803	.2231	.1768
70	530	.9651	.2326	.1825
75	535	.9500	.2420	.1881
80	540	.9353	.2513	.1936
85	545	.9207	.2605	.1990
90	550	.9065	.2696	.2042
95	555	.8922	.2787	.2093
100	560	.8788	.2877	.2140
105	565	.8650	.2966	.2186
110	570	.8516	.3054	.2232
115	575	.8385	.3141	.2276
120	580	.8255	.3228	.2319
125	585	.8129	.3313	.2360
130	590	.8002	.3398	.2402
135	595	.7878	.3483	.2441
140	600	.7756	.3567	.2479
145	605	.7636	.3650	.2516
150	610	.7518	.3732	.2552
155	615	.7402	.3814	.2586
160	620	.7287	.3894	.2621
165	625	.7174	.3975	.2653

[*Reprint from* THE ENGINEER.]

MECHANICAL MANAGEMENT.

AN ICE MAKING PLANT AND ITS MECHANICAL MANAGEMENT—HOW TO START UP AND MANIPULATE AN ICE MACHINE.

BY CHARLES EKSTRAND.

COOLING water plays a very large part in the efficiency of the ice making machine. The larger the quantity, and the colder circulating water is, the less pressure is required in the condenser to liquefy the ammonia gas (up to a certain limit), and the less pressure the compressors are working against the less power it takes to drive them; more gas can be expanded and compressed, and, consequently, more work done with less power, because effective work done depends on the weight of ammonia evaporated. To reach the best results we use, therefore: *First*, plenty of cooling surface on our condenser; *second*, cold water, and plenty of it.

We also fill the oil tank for lubricating the compressors, and start the water through the water jackets of the compressors. Being assured that everything is perfectly tight, that all valves and cocks are working easily, we proceed to remove all the air we can from the system before admitting the ammonia.

On most machines the discharge pipe is tapped between the compressors and the outlet valves, and a small valve placed therein with a pipe leading to the atmosphere. Also, on the highest point of the condenser, a small valve is placed. These are called blow valves. The first named is used when we wish to free the system from air before charging, and the last one after charging.

To remove air from the system, or create a vacuum, we open the blow valves on the discharge pipe, close the outlet valves and charging valve; let all the rest be open and start the machine. The compressors will then draw air from all through the system and discharge it into the atmosphere, thus forming a vacuum throughout the entire system. When this is done we stop the machine, close the blow valve, stop valve on receiver and expansion valves, open the outlet valve, and are ready to charge. Anhydrous ammonia comes from the manufacturers in iron flasks or fountains, which are provided with the male end of a half inch union for discharging it. We use, therefore, the female part, and a short hose connection to our charging valve. We couple on our connections, open the charging valve and the stop valve on the flask, allowing the liquid to fill the pipe up to the expansion valves, then start the machine and open the expansion valves a very little, until we feel the pipe getting cold, or see frost forming on the same, being careful that the compressors are working properly. An attendant should always be able to tell by the sound of the valves in the compressors whether they are working well or not; this can be ascertained by placing the hand on top of the compressors or on the discharge pipe. If not working properly there will be no heat, and *vice versa*.

Regulate the expansion valves so that a pressure of from ten to fifteen pounds is maintained on the expansion coils. As the flask begins to empty, the pressure will fall; then open the expansion valves wider and let the machine run until there are five inches of vacuum on the expansion coils, when the flask should be empty. If more than one flask is needed, stop the machine, close the charging valve, disconnect the empty flask, and connect a full one, proceeding as before. When enough liquid is admitted to the system, close the charging valve and open the stop valve on the receiver.

The amount of liquid necessary depends on the size of the plant; there should always be so much that when in full operation a sufficient quantity of liquid remains in the receiver at all times. A gauge glass on the receiver for the purpose of ascertaining the amount of liquid it contains is a very great help, although an experienced attendant can tell when more liquid is required by the action of the machine. When the liquid gets low the pressure will fluctuate more or less, the temperature of the discharge pipe will vary, and the valves in the compressors will sometimes run easily for a while, and then labor harder, showing that the supply, and consequently the resistance, varies. When this occurs the machine needs charging. As soon as the charging is done, and we begin to expand ammonia from the receiver, we must start the lubricating apparatus for the compressors. If the oil tank is full, we open the valve that connects the same with the separator for a fraction of a minute, allowing a small quantity of gas to enter the oil tank, so that the pressure there will exceed the pressure in the suction pipe; we then open the valve on the sight feed, allowing the oil to feed about ten to fifteen drops a minute. Care should be taken that the oil cups never cease feeding, as ammonia gas is far different from steam as regards lubrication. Steam is in itself more or less lubricating, depending on the moisture in it, but in ammonia there is absolutely nothing that will lubricate, but, on the contrary, it causes greater friction, so if the oil should be stopped it would take more power to run the machine; besides danger of scoring the rods and ruining the packing.

The amount of expansion or back pressure to be carried depends altogether on circumstances. If the brine is warm, the expansion coils very large, or at a great distance from the compressors, a higher expansion pressure can be carried. The machine is working up to its full capacity if the suction pipe is covered with frost to within a few inches of the compressors. The more gas evaporated, the more heat absorbed; but the higher the evaporative pressure, the less heat absorbed per pound of gas, so that there is a point at which economy ceases, and this point varies with different conditions, such as the relative size of the machine to the work it has to perform, the distance through which the gas is expanded, and the pressure at which the gas is liquefied.

If the machine is worked up to its full capacity, care should be taken that the bottom of the compressors is not cooled off, for then the gas will liquefy before being compressed, and the piston rod and packing being intensely cold (about 20° below zero), will contract, and gas will leak through the stuffing boxes, not only creating a terrible smell, but also going to waste. If this should happen during the temporary absence of the attendant, and the gas should be so strong that it would be impossible to go near the machine and set up the

glands, then the only thing that can be done is to close the expansion valves at once, and let the machine run until all the gas has been pumped out, or at least until it is possible to go near the machine. After the leaking has stopped and the compressors begin to assume their usual temperature, open and regulate the expansion valves again, and do not forget to slack up on the glands, or else when the packing warms up and expands, it will heat and cut the rods very quickly. If the frost on the suction pipe is kept a few inches from the compressors, the attendant can see at a glance if any variation should occur; also, whenever passing the machine, feel of the piston rods, which should always be at the same temperature.

The pressure on the compression side depends on the cooling capacity of the condenser, the amount of water, the temperature of the same, and the non-existence of air in the system. Theoretically, with a perfect condenser and with the ammonia perfectly anhydrous, or free from all foreign substances, it liquefies at a temperature of 50° F. and 95 pounds pressure per square inch; so when the circulating water is 50° we should have 95 pounds pressure on the condenser, and as the temperature of the water increases so the pressure increases, and *vice versa*.

But in practice we can never attain as good results, for these reasons: The ammonia is not always as pure as it should be, more or less air will remain in the system, the condenser is too small, or not set up to the best advantage, scarcity of water, or too high temperature of the same. Any one of those causes mentioned, or all combined, will give us a higher condenser pressure. The condenser should always be kept clean; if well water is used, all vegetable matter, or matter of any kind, should be removed as soon as shown on the pipes, so as to get all the benefit possible from the condenser. If the system should contain any air, either through the same not having been removed before charging, or through vacuum having been carried on the expansion side so that air leaked in through the stuffing boxes, or through impure ammonia, these will cause an undue pressure.

To remove the same, open the blow valve on top of condenser slightly, allowing the air to escape. Keep your hand on the valve, so that when the air is out, and you smell ammonia, you can close it at once so as not to waste any gas.

If you are limited to a small amount of water, see that its distribution is perfect, that every drop is running over, and on the pipes, instead of alongside of them; if the water is reasonably cool gather it up after it leaves the condenser, and by means of a small pump use it over again.

As soon as we have started up the ice mold can be fitted. No natural water has yet been found that will make perfectly transparent ice, not so much through impurities as through the air that it contains, so most ice making plants evaporate water in a boiler for that purpose, under a low pressure, send it through a coil of pipes, in which it is condensed, and from thence it runs by gravity into an air tight storage tank. From this tank a hose long enough to reach all the ice molds is led, with a nozzle reaching to the bottom of the mold, and a valve where the hose and nozzle connect, also a check valve at the end of the nozzle, with the stem projecting about an inch outside. In filling, the mold is set in position, and the nozzle pressed on the bottom of the mold, raising the check valve and allowing the water to flow into it; when full enough it is immediately covered. In this way clear, crystalline, and perfectly pure ice is obtained, which in purity certainly excels any natural ice.

To make the ice hard and more lasting, it should be frozen slowly; the brine should not be run to a too low temperature, and the molds should be allowed to remain longer in the brine. After the ice is taken out of the molds and stored, it should be subjected to a very low temperature, either through direct expansion coils placed in the storage room, or brine pipes therein, and colder brine circulated through them than that which was used to form the ice. This will make the ice hard and brittle as glass, and it will take even longer to melt than natural ice; twenty-four hours is generally conceded to be the best time for good ice to form, but much depends upon the size of the molds; the smaller the mold the less water it contains, and the sooner it freezes.

The best method of removing the ice is easiest explained by describing the way it is done in several large ice making concerns in the city. A traveling crane is put up across the brine tank, with tracks running lengthwise of the tank. On the beam of the crane is a track, so that the block can be moved sideways, across the brine tank from one side to the other. Two men only are necessary to operate this, and it is often done by one man.

They commence at a certain point at a certain time, generally in the morning. The outside cover is lifted off, then the cover of the mold; the mold is unfastened and hoisted up, an empty one put in its place immediately and filled, and the covers replaced.

The crane is then run to the end of the tank, where there is a slide leading to the storehouse for the ice, the mold is inverted, and a stream of water played on the outside of the same, when the ice slips out of the molds and slides into the storehouse.

The crane is then moved to the next one and the operation repeated. By working slowly, taking one mold at a time, the change is made gradually, and the temperature of the brine is not materially increased, and consequently the load on the machine is more uniform.

In starting the machine we should also start the agitators, and keep them going while in operation. The brine should be tested occasionally, and if found weak it should be strengthened. If the brine is allowed to run too weak ice will form on the expansion coils and act as an insulator. If this should happen the plant would have to be shut down and the ice allowed to melt off before any work could be done.

Whenever possible the brine tank should be emptied and cleaned, and the expansion coils examined and cleaned. Dirt or deposit of any kind on the expansion coils represents work lost.

Where the plant is used for refrigerating purposes the operation is the same as described, with the exception that the brine, after having been cooled in the tank, is circulated by means of a pump through coils of pipe placed in the room to be refrigerated. There are no agitators used in the brine tank; the suction pipe to

the pump leaves the tank at the bottom, and the return from the room enters the tank at the top. The coolest brine, being at the bottom, is drawn off by the pump, and the warmer brine comes in at the top, and as it cools it in turn goes downward, making a continuous circulation.

To successfully operate a refrigerating or ice making plant requires:

First.—A thorough knowledge of the principle and construction of the machine.

Second.—Untiring watchfulness and care.

Third.—Clear head that will not get rattled; eyes, ears and the olfactory organ must always be on the *qui vive.*

There is no class of machinery where it pays so well for the owner to have the best men at the highest price. And with no other class of machinery can so much damage be done, work lost and material wasted—by a neglectful man or a man who means well but don't know better—than with an ice making plant. I have seen, to my sorrow, engineers running refrigerating plants, who did not know the first principle of the material they were using, and consequently the largest part of their employer's profit went out in the air.

THE PROBLEM OF WATER PURIFICATION.

THE most important sanitary question now pressing for solution is that of a pure water supply for our towns and cities, says the American Medical Association *Journal.* As this country becomes more populous, the streams and lakes receive more refuse and sewage, until the purification of the water supply for a given locality has become the crying need. Statistics show that at least 55 per cent of the waters supplied to cities and towns are obtained from surface sources and are necessarily liable to more or less contamination. Various remedies have been sought for this condition. The most practical thus far suggested is to prevent the contamination, by carefully guarding the lakes or rivers from which the supply is obtained. It is at once apparent that only a certain degree of security is reached in this way, as it is clearly impossible to perfectly guard an extended water shed.

Aside from organic or infectious pollution, surface waters frequently contain fine particles of inorganic matter in suspension, or they are more or less discolored and so rendered unsightly and distasteful. This is especially true of many river waters, even when they are wholesome so far as health is concerned. Natural springs with deep wells have been considered the best sources of water supply, but unfortunately their range is limited and they offer no practical solution of the water supply of our larger towns. If we consider for a moment the sources of spring water we find that it was originally precipitated upon the surface. but as it percolates through the sand, gravel and stratified rocks it gradually loses its suspended matter and becomes clear and sparkling. The earth acts as a great natural filter, and waters found at any considerable depth are usually free from dangerous contamination, unless there has been sufficient pollution of the surface to extend some depth into the soil.

In the treatment of polluted waters this natural process should as far as possible be imitated, and we beleevi that it is precisely upon these lines that the solution of our water supply problem is to be reached. Filtration, however modified, has always been based upon one principle, that of forcing water through a substance with pores sufficiently fine to entangle the suspended organic and inorganic matter. Almost every conceivable porous substance has, at one time or another, been used in filtering water. These, however, may be divided into two classes: *First,* those consisting essentially of a porous plate or bed, such as sandstone or unglazed porcelain; and *secondly,* those in which a porous mass is formed by a substance in a fine state of subdivision, such as sand, gravel or charcoal. So far as we know, the first class have never been used on a large scale, though good results have been obtained where but a limited supply of water is required. The chief objection to filters of this class is that the interior of the bed or plate cannot be cleaned. Laboratory experience shows that bacteria soon make their way through plates of this kind. A further serious objection is that they cannot be adopted for the filtration of water upon a large scale.

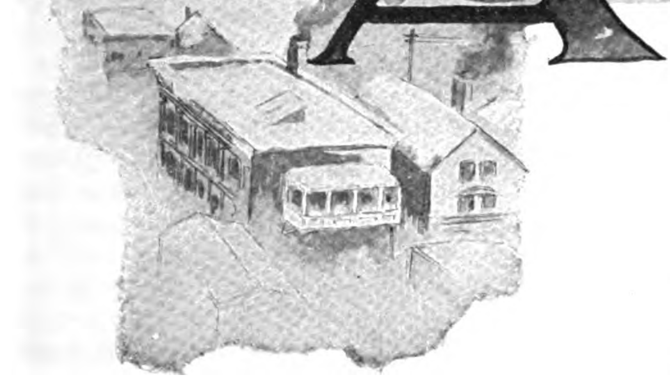
The sand filter in its various modifications is the only one that has been adopted in the filtration of waters for towns and cities. Excellent results may be obtained by simple beds of sand, allowing the water to flow over the surface and percolate through to a suitable collecting chamber below. Filters arranged upon this plan purify most of the water supplied to the city of London.

The chief objection to gravity sand filters is their great size and cost of maintenance. The outer layer of sand must be removed every few days and fresh sand substituted; and, unless the bed is carefully prepared and the water evenly distributed over the surface, crevices will form, through which the water flows without filtration.

A modification of the sand filter is one in which the bed is surrounded by a shell, and the water is forced through by hydraulic pressure; this force, if sufficient, forms the sand into an evenly resistant compact mass, comparable to a very soft sandstone. A filter constructed upon these principles and filled with fresh clean sand will give a pure sparkling water for some hours, but the outer layers soon become foul and clogged, and little or no water can be passed through; it is therefore necessary to either renew the sand, or to have some means of thoroughly and efficiently cleaning it. It is just at this point that inventors and engineers have failed. It is apparent that a filter constructed upon such principles, if the bed cannot be thoroughly cleaned, is worse than useless; it becomes indeed a positive source of danger; it is this defect that has rendered some of the devices now on the market worthless.

It has been demonstrated that a simple bed of sand arranged in this way will remove all suspended matter and most of the bacteria. Can we not look for mechanical devices that will easily and cheaply cleanse this sand? This once accomplished, one of the greatest sanitary problems of the age will be solved, and public health have taken a long step in advance.

——The safe in the office of James Russell, an ice dealer on Metropolitan avenue, Kansas City, Mo., was opened by burglars who knew the combination, on September 7. They got about $40. The outside door of the safe was opened by the combination and the inside door smashed with a sledge hammer. The office is on the main street of the town, and the police are unable to tell just when the crime was committed



[*Adapted for* ICE AND REFRIGERATION.]

ICE HOUSES A CENTURY AGO.

HOW ICE HOUSES WERE BUILT BY OUR FOREFATHERS—ICE HOUSE FOR MARSHY COUNTRIES—ICE HOUSE SUITABLE FOR DRY LOCATIONS—GENERAL DIRECTIONS.

FROM a domestic encyclopædia which was published in Philadelphia about 100 years ago the following description of ice houses as built in those days has been compiled for ICE AND REFRIGERATION. While the treatise contains perhaps nothing essentially new, it will nevertheless be found of interest by many readers for comparison of the ideas of the past with those of the present on this important subject.

An ice house, says Mr. Moase, may be built at very great expense, but it may also be built for a sum which no farmer, however poor, ought to object to. If he wish one he may have it. At Gloucester Point tavern, below Philadelphia, on the banks of the Delaware, is an ice house which fully shows with what little expense, in how simple a manner, and under what supposedly disadvantageous circumstances an excellent ice house may be built.

The ice house alluded to is sixteen feet square ; four feet above and nine feet below the surface. The marshy nature of the soil does not permit a greater depth. The pit, which slopes a little, is lined with logs as far as the surface, and faced with slabs, which are continued above ground. There is a sink at the bottom covered with logs, upon which the ice rests, and this sink empties into a pipe, which conveys the water of the melted ice or of the river, to a hogshead sunk about eight or ten feet from the corner of the house, whence it is pumped up by a common ship pump. A thick bank of earth is thrown up outside as high as the ice extends. The roof is boarded, and the entrance is through a small door at the gable end next the tavern, which is south of the ice house and but a few feet from it. Straw is liberally used to cover the ice and to line the pit. A large willow shades the ice house on the northeast and west, and the tavern protects it on the south. The ice house holds ninety-one horse car loads and keeps ice enough to supply the house until the succeeding winter in which it is filled.

The Gloucester ice house may be considered as a valuable model for all those who wish to enjoy this summer comfort, and who live in marshy countries. But in dry situations other plans may be adopted. The following is recommended by Mr. Thomas Moore, of Montgomery county, Maryland, in an excellent treatise on the subject.

"The most favorable situation is a north hillside, near the top. On such a site open a pit twelve feet square at top, ten at bottom and eight or nine feet deep. Logs may be laid round the top at the beginning, and the earth dug out, raised behind them, so as to make a part of the depth of the pit. A drain should be made at one corner. The spout to carry off the water should descend from the pit, except a short piece at the outward extremity, which ought to be bent upward a little, thus forming a depressed part, which will always stand full of water, and prevent communication with the external air. Dig holes in the bottom of the pit, and set therein four perpendicular corner posts, and an intermediate one on each side; let the insides of these posts form a square of eight feet in the middle of pit. Then in order to avoid dampness from below, cover the bottom three or four inches deep with dry sand, if it can be conveniently got. The next thing to be done, I consider as the most material and also expensive part of the business, which is fixing a proper floor for the ice to rest on. In order to do this let three or four-foot sleepers, supported at the ends, be placed across the square included by the posts; their upper edges about a foot from the bottom, but so that the plank laid thereon may have a descent of a few inches toward one of the sides next the drain. The plank should be two inches thick and about half seasoned, jointed, grooved and tongued or lathed, and grooves cut near the joints in the upper side, so as to prevent any water from going through. The floor must extend a little without the inner sides of the posts, so that the water dripping from the sides may fall on the floor. Then fix a plank or spout at the lower end of the floor in such a manner as to convey the water into the drain. The floor being completed, begin at the bottom plank up on the insides of the posts, with three-fourths or five-eighths plank (boards), lapping the lower edge of each a little on the one below, so that the water may be kept on the inside; this done to the top of the posts (which should be even with the top of the pit) and the inside will be completed, except that it will be proper to cover the floor with loose plank, previous to putting in the ice. The roof may be composed of any materials, and in any form that will defend the contents of the pit from wet, from the direct rays of the sun, and also admit a free circulation of air. I do not think any could answer the purpose better than one made of thatch, supported

by posts a few feet from the ground. The mode of filling the house remains now to be considered, and on this much depends.

"Early in the winter fill the interstice between the ice chamber and the bank with clean, dry straw, closely pressed; this being done early will prevent the earth from freezing, which would be injurious to the sides of the pit. The ice should be collected in the coldest weather. Let it be exposed at least one night to the cold atmosphere, after it is removed from the water, which will reduce its temperature many degrees if the weather is severe. When put into the house it should be beat small, and I think it would be useful frequently to sprinkle it with a watering pot, while putting in; the mass would by that means be rendered more compact. When the chamber is filled, cover the whole with a good thickness of straw, but I should suppose it would be best to cover the ice first with plank, supported by the sides of the chamber, only leaving a door to descend through.

"Such a house as has been described will contain about ten tons, and I am persuaded will be found sufficient to afford an ample supply for almost any private family.

"This is nearly the kind I had in view when I estimated the expense would not exceed $20; and if we calculated on a great part of the work being done by the family, which in the country in general it very well may, the actual outlay in many places need not be $5. Those who are less sparing of expense, if they choose, may wall, or what is better, plank up the sides of the pit, and finish the roof in a style of elegance.

"In level situations, where a drain cannot be conveniently dug out from the bottom of the pit, I should suppose it would answer very well to inclose the ice by a mound raised entirely above the surface of the earth, through which the water may be discharged; in other respects to be similar to the foregoing description. This, perhaps, would not be quite so cool a repository as if under the surface of the earth unless the mound was very thick; but I am persuaded that the loss of a few degrees in temperature bears very little proportion to the advantage resulting from dryness.

"If it were certain the floor would be perfectly tight, the passage of heat to the ice would be rendered still more difficult by confining a quantity of dry ashes, sawdust, straw or some other non-conductor between the floor and the bottom of the pit."

In Italy, where ice is much used, both as a medicine and in diet, it is formed in the following manner: Balls of snow are wetted, and placed one on another in the ice house. The bottom parcel rests on logs, through the interstices of which the dissolved water drops; and the whole mass is formed into a solid body of ice in the course of the winter.

The following points should be carefully attended to in building an ice house:

First.—Whether the pit is lined with stone, brick or logs, a vacancy should be left of at least one foot between the surrounding earth and lining, and filled with straw. The quality possessed by straw, of slowly conducting heat, is advantageously acted upon, in many instances by those who are ignorant of the principle, which is finely illustrated and proved by Count Rumford. A second wall, leaving less space between it and the first, than between this and the surrounding earth, and likewise filled with straw, would tend more effectually to exclude the heat which is commonly observed to cause great waste of ice at the sides. Straw should likewise be liberally used between the wall and body of ice.

Second.—A chimney to convey away the heated, moist air is an essential requisite to all ice houses not much used, and which are placed in unfavorable situations; it is the want of this chimney which occasions the disappointment of many persons anxious to preserve a supply of ice in summer.

Third.—Mr. Moore suggests the probability of a thatch roof being equal to any for the purpose of covering an ice house, but there can be no room for doubt of straw being the very best material for a roof within reach of the farmer. If a single roof be used, the thatch should be as thick as possible, but a double roof (each roof being thatched) would more completely keep out external heat. Where the roof consists of boards or shingles the inside may be covered with straw, to be supported by battens.

In South Carolina and Georgia, where the ice must be imported from the northern states, still greater precaution is necessary. The space between the double roof may be lined with powdered charcoal or ashes, which are well known to be the worst conductors of heat. The body of charcoal need not be more than six inches thick.

Fourth.—A floor over the body of ice would further protect it from waste by excluding heat. This floor should be covered with straw, and also have a door, to enable a person to descend to the ice.

Fifth.—Ice houses should be filled in the coldest weather, and the ice broken into lumps about the size of a man's head. Cold water may be dashed on every layer of ice, but salt must not be used. During very cold nights the door of ice houses should be left open.

Sixth.—Pits for ice houses should be dug down to gravel, or have a drain to carry off the dissolved water.

The same author also devoted some attention to the construction of a portable ice box, in which farmers might carry their butter and meat to market in order to obtain for them extra prices. The one which he made for this purpose he describes as follows:

"I had a cedar vessel made in the form of an oval tub, nearly as wide at bottom as top; in this was fitted as large a straight-sided tin vessel as it would contain, open at top. The interstices between the sides of the two vessels were covered by an edging of tin, soldered to the upper edge of the tin vessel, and extended on to the upper edge of the wooden vessel, to which it was nailed (but this edging ought to have been wood). Through this last was cut a hole about an inch and a half space on each side, for the purpose of putting in ice; over the whole was fitted a wooden lid, fastened by a hinge on one side. A coat or case of coarse cloth, lined with rabbit skins, the fur side next the cloth, and the pelt next the wood. The coat was in two parts for the convenience of raising the lid; the part attached to the lid had an edging which hung down and covered the joint when shut. The tin vessel was fourteen inches long, six wide, and twelve deep, and contained twenty-two pounds of butter, wrapped in linen cloth, and put in edgeways." This machine, the author adds, or similar ones constructed on the same principle, may be applied to a variety of purposes in families.

——L. A. Davis has sold his cold storage house at North Topeka, Kan.

[*Abstracted for* ICE AND REFRIGERATION.]

LEGAL MATTERS.

MEASURE OF DAMAGES FOR BREACH OF CONTRACT TO FURNISH AN ICE MACHINE—A TEXAS RULING IN POINT—MINOR LEGAL NOTES.

THE right to recover profits for a breach of a contract does not depend upon an arbitrary rule to be adopted by a court, but upon the principles that should control the right. The law does not condemn profits, as such, as a measure of damages. The question is, would the loss of profits be the direct result of the breach, and would such a loss "reasonably be supposed to have entered into the ,contemplation of the parties at the time of making the contract"? Conjectural profits would not be allowed, not for the reason that profits are proscribed, but because they are uncertain. If they become sufficiently certain and are the direct result of the breach, and the parties were in possession of such facts as would charge them, as reasonably intelligent men, with the probable consequences of the breach, then profits fall within the rule, and may be recoverable as damages. Speculative damages are not allowed, whether of profits or other results. Expected profits in business are generally too uncertain and remote. But any case will depend upon its own facts.

This is the ruling of the Court of Civil Appeals of Texas in the case of *Alamo Mills Co.* v. *Hercules Iron Works.* Here was a written contract on the part of the Iron Works to furnish the Alamo Mills Co., now known as the Crystal Ice Manufacturing Co., an ice making plant complete, with a daily capacity of forty tons of ice, the same to include two tanks, with all coils, valves, pumps, distilling apparatus, filter, air pumps, water coolers, charcoal filters, machinery for small water wheel, necessary change in the steam engine, well, condenser house, insulation, and all woodwork connected with the plant, etc., the plant to be two complete 20-ton plants, capable of producing forty tons of clear ice per day; one-half of the plant to be ready March 1; the second half by April 1; the same to be transferred in complete working order. To recover under this contract the above action was brought. The Iron Works alleged that it had furnished the machinery of the contract power, with the material as agreed, and of the quality stipulated, and in every particular complied with its contract, with the exception that owing to unforeseen circumstances, and what it called the misconduct of the Ice Manufacturing company, it did not have the plants producing ice until a few weeks after the date agreed upon, yet claimed to have saved the company from whatever loss it might have incurred thereby, and to have been and to be ready and willing to pay it whatever loss it sustained by reason of not having the plant in operation on April 1, if in equity it should.

In this case the court said that it did not think the allegations of expected profits from the manufacture and sale of ice during the season would be a sufficiently reliable and certain basis for estimating the damages for failure to furnish the plant according to contract, but that the profits that would have been made on a certain contract which had previously been entered into by the Ice Manufacturing company and was known to the Iron Works when it agreed to furnish the machinery for manufacturing ice, would be recoverable, as where it was in this case agreed to deliver 1,000 tons of ice when manufactured at $9 per ton, the cost of production being about $1.50 per ton, the Iron Works would be liable for the loss when, from failure to furnish the machinery in time, the Ice Manufacturing company was compelled to procure the ice to complete its contract at great expense. Moreover, the court held that in such a case as the above the expense of the time and services of a person, as of the president of the Iron Works, given after the completion of the contract, at the request of the Ice Manufacturing company would be a proper charge against the latter, though it would not be liable for it if rendered in complying with the contract to furnish and construct the plant. The distinction should be observed, the court said, between the duty of a contracting party to fully comply with its contract, and for any extra material and labor furnished upon request of the other party, or necessitated by the latter's misuse of the machine after its completion, or its acceptance as completed. Whatever work or expense was here incurred by the builder of the machine in performing its contract, or making it good according to its terms (unless waived) having been provided for in the original contract, and its price fixed, no extra charge could be made for any of it. But if extra work and material were furnished after the plant had been completed according to contract, and delivered, they would be a proper charge. So also when a man was sent by the Iron Works to repair the plant which was injured after it had been completed and turned over, the ice manufacturing company would be liable for his services. If the machine was not of contract capacity, and it was left on the latter's hands, and if it did not accept it as a compliance with the contract, it should not be required to pay the contract price for it, but the price it was reasonably worth; that is, the contract price less the damages for deficiency, which would be the difference between the agreed price and the value of the machine left on its hands.

MINOR LEGAL NOTES.

——The Middlesex Ice Co., Malden, Mass., has gone into liquidation. It will pay in full.

——The property of the Standard Ice Co., of New York city, situated at Malden, in the town of Saugerties, is advertised to be sold under foreclosure at the court house in Kingston on Thursday, November 2, 1893, at 2:00 P. M.

——Henry Schoenfield, mayor of Jacksonville, Ill., and shipper of poultry and manufacturer of artificial ice, October 15 confessed judgment in sums aggregating $40,000. He had branch houses scattered throughout the west.

——In the United States circuit court, October 5, the jury rendered a verdict for $3,900 in favor of William S. Lurton against A. B. Farquhar & Son, for failure to carry out the terms of a contract for the delivery and setting up of an artificial ice making machine. The amount represented $3,000 damages and $900 as five years' interest.

——The Mountain Ice Co., Denver, has begun suit for $2,000 damages against the Buffalo Creek Land and Improvement Co. It is charged that the defendant, through carelessness, permitted a dam, which confined the waters of a lake belonging to it, to break and flood the lands of the plaintiff and damage the reservoirs, tracks, ice houses, etc., of plaintiff.

——James L. Quackenbush, the assignee of the F. X. Kuhn Refrigerating Co., on September 27, filed the inventory and schedule of the company's property. The recapitulation shows that the firm has debts and liabilities of $24,426.74, offset by assets which have a nominal value of $31,780.34, but only $1,890.13 actual value.

——October 20, the New York City Ice Co., of No. 409 West Twelfth street, has been ordered dissolved by the supreme court, and Charles H. Macy has been appointed receiver. It was incorporated in May, 1875, with a capital stock of $250,000, and in April, 1891, leased its entire plant to the Consumers' Ice Co. It has ice houses at Athens and Catskill, on the Hudson, valued at $25,000 and $45,000, and three ice barges worth $29,000. The liabilities are $198,930, including $75,000 of bonds; assets, $100,420.

——Henry Reynolds has applied for a receiver for the Stone Lake Ice Co., and estate of Robert Reynolds, Cincinnati, his sister and brother being the defendants, the ice company and estate being practically identical. The petitioner claims that the estate has been managed in a wasteful manner and that the ice company has not been economically arranged. He alleges that the estate has paid no dividends since 1886 and the company has paid none for several years, or if either the estate or the company has paid such dividend he has no knowledge of them. Therefore he prays for a receiver.

——In the United States circuit court at Trenton, N. J.' October 3, the attorney made an application for an entry of judgment *nunc pro tunc* in the case of the *Consolidated Ice Machine Co.* of Chicago v. *The Hygeian Ice Co.* of Trenton. On May 1 a verdict for damages to the amount of $78,000 was rendered in favor of the plaintiff, and the attorney asked to have the judgment recorded. September 25 a motion for a new trial was denied and the verdict sustained, but in the meantime the Hygeian Ice Co. had gone into the hands of a receiver. The motion of October 3 was to make the date of judgment May 1 instead of September 23. This would give the ice machine a prior claim on all the property in the hands of John G. Muirheid, the assignee.

——In the superior court, at Providence, R. I., October 12 the case of *William O'Brien*, per pro ami, v. *The Fall River Ice Co.* was heard for the third time. The suit was brought by the plaintiff to recover damages for injuries which a child received while playing in the street. A wagon belonging to defendant backed into the O'Brien boy, inflicting a scalp wound which disfigures him. It is further claimed that his brain is affected and that he will never entirely recover. At the time of the accident the mother was taken suddenly ill and could not attend to the child. The defendant denies liability, and urges that due care was employed and that the child should not have been allowed to play in the street. The verdict was for defendant.

——Judge Wickes, Baltimore, handed down an opinion September 29, in the case of the *Central Trust Co.* of New York, mortgagee of the Arctic Ice Co., v. *The Maryland Ice Co.*, of Baltimore. The case has been to the court of appeals and was sent back to have the damages assessed. Some years ago the Maryland Ice Co. bought a number of ice machines from the Arctic Ice Co. The price was $83,766.66, which includes interest to October 1, 1893. The Maryland company claimed that the plaintiff company failed to put the machines in their plant within the time the contract called for, and also that they were of inferior quality. The court was, therefore, asked to decide the amount of the damage sustained. Judge Wickes in his opinion says that he thinks $9,221.50 is a just amount, and decides that the home company is still indebted to the Arctic company to the amount of $74,545.16.

——Last February the Dodsworth Distilling Co., Cincinnati, purchased an ice machine from the Hercules Iron Works. They claimed that the machine did not come up to expectations, and refused to pay for it. The Iron Works sued for the amount. After considerable litigation the Iron Works, October 13, was given a judgment for $17,024.44 with interest from February 7, 1893, in the United States court. Judge Taft, who handed down the opinion, agreed with the jury in believing that the inadequacy of the ice machine was due to a large extent to Caleb Dodsworth, of the defendant company. He, it was claimed, had stubborn views on the running of the machine, which were not based on any experience in ice making. To this the jury lays the fault of the failure of the machine to furnish twenty-five tons of ice every twenty-four hours, and Judge Taft, in his opinion, declares that he is not prepared to say that he would not have reached the same conclusion as the jury.

——John R. Mason, Esq., has been appointed receiver of the American Ice Co. This has been brought about from the fact that the company had a large amount of paper accruing, and as it was impossible to collect of its own debtors, it became necessary to have a receiver appointed for the protection of all interested. It is the intention of the company to continue business, and its liabilities of about $35,000 will be met by its assets. It has a paid-up capital of about $135,000. The company has been controlled in Washington, D. C., but now the eastern stockholders will be given the majority on the board of directors and the business will be more directly under their control. Mr. Charles E. Field, general manager of the company, will continue in that position and as the representative of the receiver. Mr. Field is now in Washington on business regarding the company's interests. The company is one of the largest in the country and besides its ice business of about 200 tons a day has a coal business of 100 tons a day. The officers are: President and treasurer E. M. Willis, of Washington, D. C.: vice-president and general manager C. E. Field, Bangor; auditor G. Y. At Lee; directors, E. M. Willis, C. E. Field, O. G. Staples, J. A. Bacon, G. Y. At Lee.

——The Wielmans-Ceuppens Brewery, Brussels, Belgium, has just set up a 65-ton De La Vergne refrigerating machine.

——The Monterey Refrigerator and Cold Storage Co., Monterey, N. L., Mexico, which was established about two years ago by Captain W. S. Carothers, of Pearsall, Tex., and closed down last spring, has been reorganized. New men and capital have taken hold of it and it will again be opened and put into working order.

NEW CORPORATIONS.

THE following new companies have during the past month been licensed to incorporate. Where further information is known of them, notice is made in other departments of ICE AND REFRIGERATION:

ICE COMPANIES.

——Pocono Ice Co., Scranton, Pa.; $50,000.

——St. Paul Ice Co., St. Paul, Minn.; $10,000.

CREAMERIES.

——Roser & Wessling Co., Kenton; $25,000.

——Walford Creamery, Walford, Iowa, $4,100.

——Mendon Creamery Co., Mendon, Ohio; $5,000.

——Axtel Creamery Co., Prairieburg, Iowa; $1,000.

——Meriden Creamery Co., Meriden, Conn.; $3,500.

——Fox Lake Creamery Co., Fox Lake, Wis., $5,000.

——Sandridge Creamery Co., Rockwell, Iowa; $3,000.

——Bureau Butter and Cheese Co., LaMoille, Ill.; $5,000.

——Pompanoosuc Creamery Co., Pompanoosuc, Vt.: $2,000.

——Clinton Co-operative Dairy Association, Howard: $5,000.

——Half Moon Bay Creamery, Half Moon Bay, Cal.; $25,000.

MISCELLANEOUS COMPANIES.

——Wickes Refrigerator and Car Co.: $50,000.

——Kupbal Refrigerating Co., New York city; $5,000,000.

——Chemical Refrigerating Co., Portland, Me.: $1,000,000.

——Snow and Ice Liquefying Machinery, Paterson, N. J.; $150,000.

——Pacific Cold Storage, Coal and Investment Co., South Bend, Wash; $100,000.

FIRE AND ACCIDENT RECORD.

——Seven ice houses at Congress lake, near Ravenna, Ohio, were burned October 9.

——The Creston Ice Co.'s house, Creston, Iowa, was burned October 19. Loss, $1,000.

——F. D. Entriken's ice house at McPherson, Kan., was burned October 8; loss, $150.

——Lyman's cold storage house, Des Moines, Iowa, was burned October 11; loss, $10,000.

——The Southern Brewing and Ice Co.'s plant at Schulenburg, Tex., were burned October 11.

——J. L. Dolans ice house and barn at Glens Falls, N. Y., were burned October 18. Loss, $500; insured.

——W. E. Scott's ice house in Shohola Glen, near Port Jervis, N. Y., was burned September 25; loss, $1,000.

——The ice houses of W. O. Leeds and Peter George, Michigan City, Ind., were burned October 9; loss, $1,200.

——The ice houses of the Cayuga Lake Ice Co., Cayuga, N. Y., were burned October 9, and 10,000 were uncovered.

——The yards of the Housatonic Ice Co., at Bridgeport, Conn., were burned October 16, causing a loss of $3,500 to $5,000; partially insured.

——The seven ice houses at Congress lake owned by the Forest City Ice Co., of Alliance, Ohio, were burned on October 13; loss, about $20,000.

——The Chautauqua Lake Ice Co. house and storage warehouse at Pittsburgh, Pa., was burned October 27. The loss will reach $250,000; insured.

——The wareroom of the Summit Refrigerator Manufacturing Co., Michigan City, Ind., was burned October 3, with 700 refrigerators; loss, $15,000; insured.

——Moulton's ice house at Bolton, Conn., was burned October 17. Loss, $5,000; insurance, $4,000; cause, unknown. It was the largest in its neighborhood, and was nearly empty.

——The Cleburne, Tex., ice factory, the property of the Cleburne Ice and Cold Storage Co., burned October 17. The plant was valued at $12,500, and was insured for $3,200.

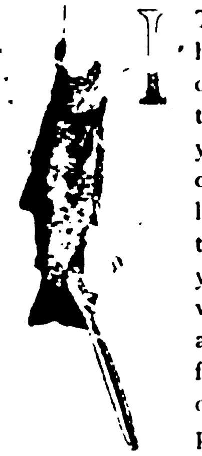
——The ice houses leased by Walter Phibbs, located on Broadway near Third avenue, Albany, N. Y., were badly damaged by fire early this morning. Loss, estimated at $2,000; no insurance.

——A large fire took place October 12 at Sioux City, among the thirty buildings destroyed being the Franz Brewing Co.'s brewery (loss, $75,000), a part of the plant of the Sioux Automatic Refrigerating Co. (loss, $10,000), and the agency of the Anheuser-Busch Brewing Association (loss, $1,000).

——On September 19, Thos. Leader, one of the owners of the new ice factory at Ogden, Utah, while in charge of the factory, was seriously hurt by a fall of piping. He had just entered one room of the factory when the stringers which held the pipes in place gave way, burying him under the great mass of pipes and ice, the combined weight of which is about a ton and a half. The most serious injuries sustained by Mr. Leader were about the head. Fortunately the skull was not fractured. The injured gentleman was removed to his home and given every medical and surgical aid.

FREEZING FISH.

HOW FISH ARE FROZEN AND PRESERVED FOR YEARS AS PALATABLE AND WHOLESOME FOOD—THE ICE MACHINE AT THE FISHERIES.



IT is unnecessary to ask if you ever have had set before you a smoking hot plate of deliciously flavored fish, a dish fit to tickle the palate of a king. Did you eat it and enjoy your dinner? Of course you did; but it didn't occur to you that that particular fish might have been dead just four years, did it? asks the Detroit *Journal.* Oh, don't recoil and wish you had not eaten fish for dinner, for the dish was just as delicate and as healthful and sweet as if the finny beauty had just been lifted from the water. It is true. Science has conquered nature and has demonstrated that to preserve fish it is not necessary to salt them.

Freezing is the thing in the future, and Sandusky, Ohio, is the place where the first attempt has been made to carry on the business in a general way. Frozen fish are taking an important place in commerce and in the cuisine, and as the industry becomes more general the demand for salt fish will probably drop off to a great extent.

About three years ago A. J. Stoll, a fish commission dealer in Sandusky, began to experiment with freezing fish, and soon found that the invention of the ice making machine would be his salvation. Last year he completed his scheme and now he has a plant in full operation, employing twenty-five men and a capacity of freezing and preserving twenty tons of fresh fish each year. In a year Mr. Stoll expects to double the capacity of the plant.

The method used is very simple, yet interesting. The fish are unloaded from the schooners and placed in the dressing vats, where the refuse matter is removed and the fish sorted and graded according to the species. This is only done with the larger fish, but the small ones are not mutilated. The fish are placed in pans made of metal that will not rust, being placed in layers and the pans carried to the cooler. This cooler is a sort of a vault filled with pipes arranged in tiers and compartments like the shelves of a pantry, and made to fit so perfectly that no space is wasted. These pipes are filled with freezing fluid and the temperature is kept at zero. From here, after freezing twenty-four hours, the pans are removed to the preserving vaults, where they are placed on pipes arranged as in the first mentioned vaults.

Just step in once, after standing around in the hot sun of a July day. Of course overcoats are neglected in the summer, but in two minutes you discover yourself in the atmosphere of the Arctic regions, and, glancing at a thermometer, you will see the mercury registered at eighteen below zero. A massive door is opened, and before your eyes is a big stack of block wood—no things are what they seem, for you find the wood very cold. It is the fish that will be distributed to your market man, perhaps many years hence, and the meat is so frozen that when emptied from the pans the fish appear like chunks of wood, and are so solid that they must be thawed several hours before the fish can be separated.

It has been demonstrated already that flesh kept frozen at such a low degree of temperature will remain perfect for a period of years, and it is believed that the fish may be preserved ten years, and then be turned over to the fish dealer fresh as the day they were caught.

Brine is circulated by the pumps through every foot of the pipes, and returns to the tank for cooling for redistribution in the space of one minute. The Sandusky plant cost $25,000.

FISHING NOTES.

——The cold storage house at Tillson's Wharf, Rockland, Me., is handling some 75 barrels of fish daily.

——The great storm on the Gulf of Mexico, about October 1, destroyed the oyster plant of the Booth Packing Co., at Portersville, Ala.; loss $100,000.

——The fishing industry in North Carolina is increasing rapidly. The shipments of salt water fish from Washington, N. C., frequently reach 10,000 pounds daily in the season.

——The Gillers' Association, of Harford county, has been organized at Bel Air, Md., Hiram C. Cobourn, James J. Gibson, R. Spencer Day, Wm. F. Day and Thos. W. Sanders, of Havre-de-Grace, being the incorporators. The object of the association is the packing, selling, warehousing and forwarding fish and ice. Messrs. Cobourn, Gibson and Sanders are directors for the first year.

——I. M. Kelley, S. F. Lockwood, Anthony Bowen, G. W. Olney and Thomas Poney, of South Bend, Wash., together with J. C. Gosnell, of Willapa, have formed an incorporated company with $100,000 capital for the purpose of operating a cold storage plant for freezing fish and shipping oysters and clams at South Bend. The plant has been purchased and operations will be commenced in the near future.

ICY ITEMS.

——The ice factory at Eugene, Ore., has shut down for the season.

——The Crystal ice factory, Laredo, Tex., has been temporarily shut down.

——Peter Walters has sold his ice business at Brainard, Minn., to Nels Peterson and Peter Standel.

——J. E. Dixon, of Birmingham, Ala., succeeded Mr. Young as manager of the Tuscaloosa (Ala.) Ice Co.

——The estate of John Hilt, late of La Porte, Ind., valued at $500,000, is in litigation on a contest of the will.

——Marshall, Mich., has an ice famine, and very little if any of the commodity is delivered to private residences.

——The Ice and Cold Machine Co., St. Louis, will place a new ice machine in the plant of the Home Brewing Co., St. Louis.

——The first building in Laramie, Wyo., "The Tivoli," has been sold to Mr. John Huempfner, who will use part of it for an ice depot.

——The Northern Steamship Co., Buffalo, N.Y., has ordered two 8-ton De La Vergne refrigerating machines to go into two new steamers of that line.

——Thos. L. Rankin, Sackett's Harbor, N. Y., received an award October 3, on his interesting "Ice Railway," seen all summer in Midway Plaisance.

——Capt. J. F. Harris, of the Northern Lake Ice Co., Lafayette, Ind., has disposed of his interest in the Artificial Ice Co. to a gentleman from Logansport.

——The employes of the Drivers' Union Ice Co., Boston, held their third annual ball in Monument Hall, Charlestown, October 18. Over 500 couples were present.

——Westerlin & Campbell, Chicago, have taken a contract to put in two 100-ton condensers of their new type for the H. L. Hoster Brewing Co., Columbus, Ohio.

——After an idleness of many weeks, the Hercules Iron Works, of Aurora, Ill., has started up with a small number of hands, and operations will be resumed in full as soon as possible.

——The Pennsylvania Iron Works Co. announce that Mr. A. P. Criswell is no longer in their employ, and that the Chicago office, No. 52 East Lake street, has been closed. All communications relating to the business of this company should be forwarded direct to the general offices, Philadelphia.

——The Natchez Ice Co., Natchez, Miss., closed their factory October 7, as they have on hand a full supply of ice for the season. This is much earlier than they have closed any previous season, but owing to the somewhat reduced demand they have been able to fill their storerooms much earlier than formerly.

——The following breweries have put in De La Vergne refrigerating machines this summer. Theo. Ham, St Paul, Minn., 65-ton, with compound condensing engine; Wm. Gerst Brewing Co., Nashville, Tenn., 65-ton; Consumers' Brewing Co., Lowell, Mass., two 50-ton machines; Magnus Beck Brewing Co., Buffalo, N. Y., one 100-ton machine; Fitzgerald Bros., Troy, N. Y., one 100-ton machine; Waukesha Springs Brewing Co., Waukesha, Wis., one 50-ton machine.

THE money stringency and its aftermath, the do-nothing policy of the Senate, have had their logical effect in depressing business of every sort, and have been no less severe with the ice making than with other industries. At this writing it would seem that the senate, or a majority thereof, had concluded to do something, and so end the uncertainty of what the future is to be, this uncertainty itself being as disastrous to business, perhaps, as any policy crystallized as law could be, for no condition is possible to which human nature cannot adjust itself; but in the face of uncertainty the most fertile in expedient are powerless. The financial question settled, however, there is no reason why business of all kinds, especially in this line in which we, the reader and publisher, are most interested, should not speedily be revived and again be standing on its own proper footing. There is ample money, as the late bank reports showed, to induce investments in legitimate enterprises as soon as the uncertainty of the character and quality of our currency is removed. Action by the senate will remove that uncertainty, and so start the wheels of industry going again.

The record of new work in building, either of ice factories or of cold storage houses, is not a large one this month. However, as the editor hardly expected to find anything to report, he is gratified to know that there is still something; and he prophesies from this fact that the future will show a constant improvement in this respect.

ARKANSAS.

Little Rock.—The Little Rock Ice Co., L. W. Cherry, secretary and treasurer, and James Spargo, engineer, has just completed an addition to that plant costing $50,500, which will give the plant seventy-five tons additional capacity. The managers have also just completed a cold storage warehouse at the west end of their plant which they rent out to persons having perishable produce. These rooms are rented for the storage of beers, celery, etc. This company also operates a 30-ton plant in North Little Rock, which is at present shut down, owing to the high railroad rate ($20 a car), placed on shipments of ice from Little Rock to Texas points, which compelled the company to close down their factory. The company has contracts to furnish all the A. R. T. and U. R. T. cars that pass through here for northern or southern points. The company does an exclusive wholesale business, and employs an average force of twenty hands, and has a total capacity of 110 tons daily, while when their North Little Rock plant is in operation their output is 140 tons per day. They use artesian well water exclusively.

CONNECTICUT.

New Haven.—The cold storage rooms of the Hygeia Ice Co.'s plant have been entirely occupied for the past three months by the local dealers in perishable goods, each of whom has his own section where his goods are stored or frozen (chiefly fish, meats, game and similar articles, which are frozen solid); this portion of the business has been so very satisfactory that a large addition will be built soon to accommodate the increasing trade.

FLORIDA.

Cocoa.—G. G. Springer, of St. Augustine, has put up a new ice factory here, which will be in charge of Mr. H. W. Steer, of Philadelphia, Pa. An artesian well has been drilled, and the plant was contracted to be ready for work November 1.

Key West.—Scott & Curry's new ice factory is finished and in operation. They will drill a second artesian well.

Orlando.—It is rumored that another ice factory is to be erected here.

Tampa.—The Tampa Ice Co. is rapidly pushing the work on its new factory.

ILLINOIS.

Chicago.—At a recent meeting of the stockholders and other parties interested in the completion of the Cold Storage Exchange structure, at West Lake and West Water streets, it was found that it would be possible to go ahead with the work. The owners have agreed to reduce the ground rent from $45,000 to something less than $30,000 per year, and this, if the stockholders will raise $100,000 and reduce expenses of administration, will admit of completion of the work and conduct of the enterprise on a paying basis. The company was organized about three years ago with a capital stock of $1,000,000, there being $500,000 of preferred stock paying 7 per cent and $500,000 of common stock. An issue of bonds was also made amounting to $200,000, of which $2,000 have been canceled, leaving outstanding $198,000. The property, West Lake and West Water streets, was leased from John B. Colgate, the Trevor estate, and John A. Stewart at $45,000 per year. Difficulties arose and work on the buildings for the improvement of the ground was stopped. Last June the affairs of the company went into the hands of a receiver. George M. Moulton, the president of the corporation, was appointed to the office. The other officers of the company at present are: E. G. W. Reitz, vice-president; Adolph Loeb, treasurer; Charles M. Stratton, secretary; W. W. Hook, general manager.

Chicago.—The Western Refrigerating Co., corner State and Michigan streets, has been making extensive improvements in that plant this summer. Two 50-ton atmospheric ammonia condensers of a new and improved make have been placed and two large rooms have been fitted up for freezing. These rooms can easily be held below 0° F. They have been run for some time at —5° F., but in usual practice will be run at or about 0° F., and are examples of the best practice in this work. Messrs. Westerlin & Campbell, 26 West Lake street, Chicago, contracted for and erected this work, and the coils for their new improved condenser (patent applied for) were made for them by the Samson Steam Forge Co., Chicago.

Fairbury.—*Record*, October 6: Westinghouse, Church & Co., ice machine manufacturers, Boston, had a representative here this week figuring with our capitalists on establishing an ice manufacturing plant here.

Taylorville.—W. N. Adams has completed cold storage and ice cream building. The building is 18×60 feet, and twenty-two feet in height; the stack, sixty feet high, the whole being built of brick, and is a very substantial edifice. The north end of the building will be designed for cold storage for meat, butter, eggs.

LOUISIANA.

St. Mary.—Dr. Gates, proprietor of the ice factory, is contemplating the erection of a cold storage warehouse in connection with the works, which will be filled for next summer's trade. As soon as its capacity is tested, the doctor will put in a larger machine in order to keep up with the increasing trade.

NEW YORK.

Canton.—R. E. Cleveland and Chas. Tallman have purchased land on which they will build a complete modern cold storage house.

Ogdensburg.—On October 14 the new cold storage of Messrs. Mitchell & Dexter now building at the Northern depot, is 48×84 feet, and three and one-half stories high. The frame is covered and ready to receive the roofing and the external sheet-iron covering. There is a large number of workmen employed upon it and the complete structure will probably be ready for business by the early winter.

PENNSYLVANA.

Wilkes-Barre.—Stegmaier & Son have just completed an ice factory addition to their brewing plant. The building containing the ice plant is 30×50, and thirty feet high, built of iron brick, and including the plant, cost $65,000. The first floor is of oiled pine, the walls being wainscoted with varnished yellow pine, making the room pleasant and inviting. The second floor, containing the four water tanks, each having a capacity of about 500 barrels, is asphalted. This weight is supported by four heavy iron pillars. A circular iron stair leads to the second floor. There are two ammonia compression machines, each with a capacity of sixty-five tons of ice each twenty-four hours; the engines are 100 horse-power. The machinery was erected by John Featherstone's Sons, Chicago, Henry Kreiss personally superintending the work. There are three brine pumps, one water pump in case of fire, and two dynamo engines supplying the entire plant with electricity. Just at present Mr. Stegmaier is not making any ice, but is using the machinery for cooling the entire brewery.

TEXAS.

San Marco.—It is rumored that a 6-ton ice plant is to be started here.

——The Penberthy Injector Co., of Detroit, Mich., who have heretofore confined their efforts principally to injectors, are as fast as possible getting out patterns for several new specialties to combine with their present business. Unless some complication unlooked for occurs, they will put on the market this coming spring a sight feed lubricator, an automatic starter for pumps or injectors, a low water alarm and a lawn sprinkler. The steam using public may expect something good, new and novel.

ICE AND REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION, THE TEXAS ICE MANUFACTURERS ASSOCIATION AND THE FLORIDA ICE MANUFACTURERS ASSOCIATION.

.·. NOVEMBER, 1893 .·.

RATES OF SUBSCRIPTION.

IN ADVANCE, POSTAGE PREPAID.

United States, Canada and Mexico, - - - - - $2.00 a Year
All other Countries, - - - - - - - - - 3.00 "

Single copies 25 cents. Advertising rates on application to the offices. Remittances must be made by post-office orders, postal notes, international money orders, checks or drafts on New York, Chicago or London, payable to H. S. RICH & Co.

H. S. RICH S. P. FOWLER J. F. NICKERSON JNO. GLENN COLLINS

H. S. RICH & CO.
PUBLISHERS,

177 La Salle St., Cor. Monroe, CHICAGO.
206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

*** ICE AND REFRIGERATION is issued promptly on the 1st of each month. The first advertising forms go to press on the 20th and the last on the 27th or 28th. Changes in advertisements should be sent in before the 20th.

INDEX TO ADVERTISERS.

THE reader's attention is directed to the first paragraph of the article, "The Trade," page 333. The editor would like a free expression of opinion by subscribers as there asked for.

SOME REMARKS.

THE writers of the following good words in reference to ICE AND REFRIGERATION will please accept our thanks:

[WETMORE & GLADWIN, Titusville, Fla.]

ICE AND REFRIGERATION is just the work for every ice manufacturer in the land. We would not be without it on any consideration.

[PROF. GUTERMUTH, Germany.]

[The following is from a paper treating on refrigeration in the United States by Prof. Gutermuth, which appeared in the *Zeitschrift des Vereins deutscher Ingenieure*, Vol. XXXVI, page 854.]

The great technical interest taken in the production of and utilization of refrigeration and the great importance of this branch of industry (in the United States) finds also expression in the trade press through the journal ICE AND REFRIGERATION, which has been published for several years and which is actively supported by all those connected with this industry in America.

EXIT THE FAIR.

WHEN this number of ICE AND REFRIGERATION reaches the reader, the great World's Columbian Exposition will have passed into history; its meteoric flash will have been extinguished, and the most perfect architectural spectacle the world has ever seen will have been given over to the wreckers for obliteration from off the face of the earth.

"The World's Fair was pervaded by an Oriental feeling for magnificence, for huge measurements, for colossality, which is, indeed, profoundly harmonious with the American national spirit," says Denton Snider, the critic. "The great country stretches the mind of its people, and makes it mighty and aspiring, truly limit-transcending"; and this undoubted characteristic of the Anglo-Saxon in America was reflected in this great Fair. "Still the gigantesque is barbarous till it be trained to order and harmony." Dean Swift's Brobdignagians were a frightfully homely race, coarse, *grossier*, like a rank growth of flags in a tropical marsh; and so we imagine all great things to be, and so most often they are. But the World's Fair was an exception. "As the Greek heroes of civilization—Hercules, Theseus, Bellerophon--had to subdue primeval monsters of various kinds, so Greek art has had to transform the monstrous in shape and to subject the colossal to the law of beauty. This function was most nobly fulfilled at Jackson Park," says Mr. Snider. The World's Fair, therefore, Brobdignagian in everything, had the exquisite beauty of the Lilliputian, the cameo; and that the thought of the destruction of these perfect buildings comes home to every visitor as a calamity and a personal bereavement, like the wanton death of a dear friend of one's youth, is the unanswerable proof of the supremacy of the art they expressed; for, as Richard Harding Davis has said, the architecture of the World's Fair has had to stand

alone; it had no past, like the Parthenon, to lift it up by its sentiment and its witness to sublime achievement for a liberty and culture which is the heritage of mankind. "And what is still worse, it had no future!" Nevertheless, the architecture was "the first thing which one looked at on entering, it was the last thing which one lingered over on leaving"—"its harmony was felt as soon as one entered the grounds and took the first look"; it will linger in our memory until the hour of *adsum* and the beyond.

In looking back upon this superb and magnificent spectacle, which from every artistic standpoint cannot fail to have a marked effect upon the æsthetic development of America, we have some reason to rejoice as well that the science of refrigeration has been in a measure exploited—not as one could have wished, however, as an exhibit pure and simple, as was progress in electrical science, but even as a concession, the condition to which it was actually reduced. The Fair has demonstrated this much, therefore, that refrigeration is even now too young a science to have truly impressed its importance to the world upon even the directory of the late World's Fair, far- and broad-visioned as we may say they in many respects were; but in the next World's Fair which in magnitude and scope approximates the late one, be sure that refrigeration, in its place as a conservator of the world's food, will not be relegated to a place at the "back gate of the servants' lodge," as it was at Jackson Park, save when it paid its way to a front seat and bought for itself public notice.

In previous issues of ICE AND REFRIGERATION we have told our readers all there was to tell of the exposition of the science of refrigeration at Jackson Park of a novel nature, or that had a new idea to advance. Practically nothing, however, has been added to our knowledge in this department of learning by the Fair. The Hercules Iron Works cold storage house, had it escaped its awful fate, might have told us something of value; T. L. Rankin and the De La Vergne Refrigerating Machine Co. have demonstrated the great availability of the ice machine for amusement purposes, and the "Ice Railway" of the plaisance will surely be seen again; and T. L. Rankin has also demonstrated that a rotary ammonia compression pump will compress gas; while Henderson, Thoens & Gerdes have shown the world, experts in refrigeration or mere *dilettanti* in the art, that there are possibilities and capabilities in the absorption machine which all the science of the continental schoolmen, however learnedly and graphically marshaled, cannot argue out of existence.

There is nothing new in all this, of course; what was needed were exhibits that would have shown the assembled nations what refrigeration really is; what it means; what it can do for mankind; and what a luxury ice is the world over, and also how machinery can now give this luxury to every land that asks for it. Nothing of the kind was accomplished or attempted to be accomplished by the managers of the World's Fair, who spent millions on electric lights which are as familiar in Hong Kong, Tokio, the interior of India, South Africa, or the "Isles of the Sea," as the Bank of England's "five-pun" notes; yet America is the home *par excellence* of the refrigerating and ice making machine, and has done more with it, perhaps, than all other peoples combined.

But "everything comes round to him who waits."

ANSWERS TO CORRESPONDENTS.

COOLING BEER WORT—FROZEN MEAT—ARTIFICIAL AND NATURAL ICE—SELF-PURIFICATION OF WATER—STORING ICE—SOME COLD STORAGE QUESTIONS.

[This department of ICE AND REFRIGERATION is conducted for the benefit of the trade generally, as well as individuals; and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

COOLING BEER WORT.

To the Editor: In order to cool beer or fermenting wort by means of a refrigeration coil, would it be better to pass anhydrous ammonia or to pass cooled salt brine through the same? In case there should happen to be a small leak, would this be more objectionable in the case of ammonia or in the case of salt brine?

F. A. W.

ANSWER.—We should think that it would make no difference whether anhydrous ammonia or salt brine is used, provided the coil is proof and the proper temperatures are observed in either case. A leak in the coil would be objectionable under any circumstances. A little salt brine diffused in the beer may be less objectionable than an equal amount of anhydrous ammonia, an amount equal to or in excess of that requisite for the neutralization of free acid in beer. On the whole, however, no argument should be entertained on this question, since the coil must be so made and tested in every case that a leak is simply impossible.

FROZEN MEAT.

To the Editor: From former statements in your esteemed magazine we see that you hold that the nourishing qualities of frozen meat (if properly thawed out) are equal to that of fresh meat. We think ourselves that you are correct in this, at least so far as the meat in question is to be subjected to a cooking or frying process before it is consumed, but we are not so sure as regards meat to be eaten raw, as is done not only by cannibals but also by some civilized people, especially such as are in poor health. What is your opinion on this branch of the subject?

P. T. H.

ANSWER.—As far as the nourishing property is concerned, that is, speaking quantitatively, we think they are not materially affected by the freezing of meat if practiced with the usual precaution. Nevertheless the readiness with which the raw meat is digested or with which its constituents are absorbed by the human system may be interfered with to some extent. There seems to be in raw meat the same as in other raw edibles outside of the nourishing quality a certain vital principle which we know is affected more or less by freezing in some cases, and it stands to reason that the same is the case in the freezing of meat. Thus it is well known that the juices of limes, lemons and other fruits are remedies against scurvy, but, as Lieut. Schwatka remarks, that these juices must be obtained from fresh fruit, and that the fruits lose their anti-scurvy properties if they are frozen. We know that the blood corpuscles of the meat are burst during freezing and lose their identity as such, and it may be argued that this or similar changes do also tend to deteriorate the value of meat in those cases in which its raw consumption is deemed desirable. But even if this conjecture should prove correct, it would not follow that in case none but frozen meat could be obtained it would be better to eat the same cooked or fried than to eat it raw in all cases. The raw beef, even if it be frozen, is nevertheless more readily digestible than the meat operated upon by heat; and while perhaps not all the benefit can be derived from frozen meat that can be obtained from fresh meat in the case of invalids and reconvalescents, the advantage would nevertheless be in favor of the

raw meat whether fresh or frozen. In this connection it would also be well to consider that meat can and actually is properly preserved at a temperature sensibly above that at which actual freezing takes place, and meat preserved in this manner is doubtless equal in every respect to the fresh article, whether the same be consumed raw or cooked.

ARTIFICIAL AND NATURAL ICE.

To the Editor: Which ice keeps longer, natural ice or artificial ice? We have heard that natural ice would not melt as quick as artificial ice, and therefore would last longer in the ice box. Can you decide the question through your valuable journal?

C. H. B.

ANSWER.—We believe that we have answered this question before, and perhaps more than once on the basis that the heat absorbed by one pound of ice while melting is the same with artificial as well as with natural ice, provided they both had the same temperature to start with; consequently the actual refrigerating effect is the same in both cases, and even if the one should melt slower than the other (which, however, we think it does not in the generality of cases), then this would simply amount to retardation of the cooling, in that it would lessen the intensity of the refrigeration to a certain extent. If it were only a question of keeping the ice intact, it would be good policy to wrap the same up in a blanket and paper before putting it in the ice box; it will then last much longer, but in doing so it will be found that in most cases the temperature of the ice box runs too high. In case it did not, it would doubtless effect a certain saving.

SELF-PURIFICATION OF WATER.

To the Editor: I have frequently heard that water purifies itself. Does this only apply to water flowing in rivers? How does the purification take place, and can it be made use of artificially to purify polluted water?

J. C. F.

ANSWER.—The self-purification of water consists in the conversion of organic matter, whether animal or vegetable, into harmless constituents, which is effected by means of the oxygen contained in the water, which causes the noxious substances to undergo a kind of slow combustion within the water. This action is doubtless assisted somewhat by the action of light, and more particularly by the direct action of the sun; but it also goes on in the dark, and for this reason not only the flowing water in rivers, etc., is purified, but also the underground waters. The oxygen in the first case is derived directly from the atmosphere, and in the latter case it is found in the water as contained in the pores of the soil it traverses. In this way the underground water is frequently found much purer than the surface supplies, the oxidizing action being supplemented by the filtering process which the water is also made to undergo while passing through the porous strata. As to bringing about an artificial purification of water by similar means, it can doubtless be done, and of course, time and space would have to be given to the water in the same manner as provided by nature. Thus by running the water over graduators, such as are used for concentrating brine, the purification may be effected in the course of time, but we think the lifting of the water, loss by evaporation, etc., would be obstacles in the way except in special cases.

STORING OF ICE.

To the Editor: Will you please answer in ICE AND REFRIGERATION what is the best thing to pack artificial ice in for use through the summer? We have been using sawdust, but it gives very poor satisfaction. How would hay or straw do? We fill our ice house every winter to help us through the summer.

S. B. C.

ANSWER—We do not believe that hay or straw will give you any better satisfaction than does sawdust, and unless the former materials were much cheaper than sawdust we would not advise you to use them in preference to sawdust. If the latter material does not answer, we may assume that your ice house is not in good condition, or that you do not use proper care in packing and withdrawing the ice. As to these latter operations, a number of points should be observed, of which we briefly mention the following: (1) The ice should be made at sufficiently low temperature, not above 10° and 14° and stored away as cold as possible. (2) Care should be taken to prevent the air from striking the unprotected ice, and not to use too thick a layer of sawdust, as this would create heat in itself, and injure the ice. (3) Have the shavings or sawdust always perfectly dry. (4) In withdrawing ice see that the water from the top does not get down to the ice below, which can be avoided by taking care that the shavings on top are always dry.

COLD STORAGE PROBLEMS.

To the Editor: Would you kindly answer the following questions in your next issue of your ICE AND REFRIGERATION, and oblige a subscriber: *First*, is chloride of calcium good for drying and deodorizing refrigerator rooms? *Second*, will it by drying the rooms assist in reducing the temperature? *Third*, is it injurious to butter, eggs, fruit or poultry if placed in the same room? *Fourth*, can it after doing its work in the rooms be used for making brine to circulate through the house; if so, how must it be used and what are the advantages over salt? *Fifth*, what is the cheapest and most practicable method of restoring it to a powder after it has absorbed moisture? *Sixth*, which of the following articles can be safely kept in the same refrigerator room without injury to the other, the temperature being above 32°: butter, eggs, poultry, fresh meat, fruit, fish and cheese? *Seventh*, which of the above goods are most benefited by dryness?

H. W.

ANSWER.—*First*, chloride of calcium is good for drying rooms and in a measure also acts as deodorizer, as it absorbs vapors charged with odorous matter. *Second*, its use will not reduce the temperature. *Third*, it is not injurious to any one of these articles if placed in the same room with them. *Fourth*, it can be used for making brine to circulate through the house; it is used for this purpose the same as salt is used, but it has no advantage over the salt—none at all. *Fifth*, one way to restore the chloride of calcium is by desiccating the same in an iron pot heated by fire, the contents being well stirred meanwhile to prevent the formation of large solid chunks. It can be powdered fine in an iron mortar, but we do not think that it should be very fine for your purpose; for large quantities the use of a reverberatory furnace would be more economical and probably also give better results. In such a furnace the hot air or fire gases generated in the fireplace pass right over the chloride of calcium placed in a chamber adjoining the fireplace, while the mass can be moved about by stirring the same through a hole in the furnace wall. *Sixth*, we know of no reason why all of these articles should not be kept in the same refrigerator room, provided you can regulate the temperature to suit each one of them equally well, and, provided also, you can keep the room sufficiently dry. There is more or less objection to storing eggs and butter with meats, fish, cheese, etc., because it is believed the delicate flavor of eggs and butter is affected by them, for which reason it is well enough to keep

different articles reasonably well separated in cold storage, if it can be done without too much inconvenience. *Seventh*, absolute dryness is not required for most of the goods mentioned; indeed, the appearance of some of them would suffer, if they were kept too dry. Butter and cheese are, if anything, less susceptible to the dangers of dampness than poultry, fish and meat, and these perhaps even less than most fruits, as the latter are generally covered with a layer of dew containing a variety of germs. Absence of actual dampness or of air saturated with moisture, or nearly so, is an absolute requirement in successful cold storage; eggs in cases, however, should be kept in a perfectly dry atmosphere.

NEW BOOKS.

VADE MECUM. A Work of Reference for the Use of Architects, Iron Workers, Builders, Engineers, etc. Compiled and arranged by D. B. Dixon; and a Comprehensive Treatise on Electricity, by G. Grier. Chicago: Laird & Lee, 1893; pp. 480. Price, $2.50.

This book treats on a very wide range of subjects and will be found a very handy companion for reference for daily use in the many deliberations occurring in the various branches of engineering, contracting, building, operating works and machinery, etc. It contains hundreds of tables, rules and data especially prepared to meet the wants which present themselves in practical workings and calculations of every kind. By its aid many a weary search in larger and more pretentious books may be dispensed with, and the labors of calculation may be greatly abridged or entirely avoided. A comprehensive index greatly enhances the value of the book, and it is just the thing for those who have to deal with power, refrigerating, electric or any other kind of machinery.

ORIGINAL PAPERS ON DYNAMO MACHINERY AND ALLIED SUBJECTS. By John Hopkinson, M. A., D. Sc. F. R. S. New York: The W. J. Johnston Co., Limited, 1893; pp. 249. Price, $1.

This collection includes all articles written on electro-technical subjects by the distinguished author, most of which have marked eras in the advance of electrical science. In the first four papers that invaluable aid to the study and design of dynamos, the characteristic curve, was first announced and developed. The fourth and fifth papers furnished the fundamental principles upon which the design of continuous current dynamos is now based. The sixth paper establishes the important principles in regard to coupling alternating current machines; the next three papers are on the transformer, and the remaining two are on the theory of the alternate current dynamo and electric light houses, respectively. These papers, with the authorization of Dr. Hopkinson, are for the first time published in a collected form and rendered accessible to the general public, and they should furnish a fruitful source of inspiration to those in search of knowledge at first hand.

CATALOGUE. Wainwright Manufacturing Co., of Massachusetts, 8 Oliver street, Boston, 1893. 16mo, 75 pp., paper. Sent free on application.

This is the latest edition of this company's catalogue of corrugated copper tube, feed water heaters and purifiers, surface condensers, expansion joints and corrugated copper gaskets. Detailed information in reference to all these specialties is furnished in a compact and clear manner, illustrated by engravings. The little pamphlet also contains some twenty or more papers of "Valuable Points for Practical Use" in reference to weights and measures, efficiency of fuels, and other subjects connected with mechanical engineeering.

COLD STORAGE EXCHANGE.

The announcement is made that at a recent (October) meeting of the stockholders and other parties interested in the completion of the Chicago Cold Storage Exchange plant, at the west end of Lake street bridge, it was found that it would be possible to go ahead with the work. The owners have agreed to reduce the ground rent from $45.000 to something less than $30.000 per year, and this, if the stockholders will raise $100,000 and reduce expenses of administration, will admit of completion of the work and conduct of the enterprise on a paying basis.

The company was organized about three years ago with a capital stock of $1,000,000, there being $500,000 of preferred stock paying 7 per cent and $500,000 of common stock. An issue of bonds was also made amounting to $200,000, of which $2,000 have been canceled, leaving outstanding $198,000. The real property was leased from John B. Colgate, the Trevor estate, and John A. Stewart at $45,000 per year.

Difficulties arose and work on the buildings for the improvement of the ground was stopped. Last June the affairs of the company went into the hands of a receiver. George M. Moulton, the president of the corporation, was appointed to the office. The other officers of the company at present are: E. G. W. Reitz, vice-president; Adolph Loeb, treasurer; Charles M. Stratton, secretary; W. W. Hook, general manager.

HERCULES ICE MACHINE CO.

The business of the Hercules Iron Works, whose financial troubles are known to the trade, has been entirely reorganized, the old ownership having been succeeded by the Hercules Ice Machine Co., who have purchased the entire property, real and personal, of the Hercules Iron Works.

The plant will be operated as formerly, the new company having a capital stock of $500,000, and all the officers of the Hercules Iron Works are included in the directory and official staff of the company. The directory is as follows: David Kelley, president of the Kelley-Maus Co., Chicago; W. H. Cotterell, of the E. P. Allis Co., Milwaukee; Edward Worcester, formerly of the Western Tube Co. and the National Tube Works Co.; Wm. George, of Aurora; Charles A. McDonald, John B. Skinner, Hon. T. C. McMillen, of Chicago. Mr. Joseph Koenigsberg, formerly secretary of the Consolidated Ice Machine Co., of Chicago, has been appointed eastern agent, occupying offices in New York City at 213 East Fifty-fourth street.

The new company have started up the works again and have already several orders on their books.

MIDWINTER FAIR.

The Pacific Ammonia and Chemical Co., Webster and Francisco streets, San Francisco, send us the following information in reference to the ice skating rink for the coming Midwinter Fair: "A concession was granted October 10 to W. N. Donaldson and Hugh Hume for a real ice skating rink upon the grounds of the California Midwinter Exposition. The name of the company represented by these concessionaires is to be the Polar Ice Skating Rink Co., and will be composed entirely of San Francisco gentlemen. The concessionaires guarantee that this shall be a first-class institution, and they will expend not less than $50,000 in the establishment of the plant, which will be equipped with Hercules refrigerating machines, built by the Hercules Ice Machine Co. The rink is to be in a building 200×250 feet, constructed in accordance with the established style of other buildings in the Exposition, and made artistically picturesque. The exact location of the building has not yet been determined, but it will be at some point of the Exposition easy of access and where the novelty of skating on real ice can be enjoyed to the fullest extent by those who come to the Fair. The ice will be formed by a process for which the company controls the patent, and will be kept as smooth and clear as glass, so clear in fact, that one can use the surface for advertising purposes without having the advertisements marred by the steel blades of the skates."

AS TO AWARDS.

Such of our advertisers as have been notified of awards to them on exhibits by the World's Fair judges, will confer a favor on the editor by forwarding information of the same to this office.

——Krieger & Klumpp's ice house at Rich Hill, Mo., is being repaired.

——The Parsons (Kan.) Ice Co. are putting up an ice house on Corning avenue.

——The Yonkers Ice Co., Stuyvesant, N. Y., are putting a new roof on their ice house. The men doing the work are from Yonkers.

——Workmen in the interest of W. A. Boley Ice Co. and Pekin Lake Ice Co. are cleaning the Pekin lake near Pekin, Ill., of the moss and other water grass, so as to have as large a territory as possible for the coming freeze-up.

THE ICE TRADE

THE TRADE.

THE editor recently addressed a number of gentlemen in the trade in all parts of the country, asking them to report to us their experience as dealers during the past season. Some of these have made replies; others, we trust, will do so later, making suggestions looking to an improvement of business in localities where it has been unsatisfactory, and to the maintenance of a satisfactory trade wherever it has obtained. All our readers without exception are invited to participate in this symposium, as we believe an exchange of views in this way cannot fail to be an advantage to the trade. The suggestions thus far received are given below.

TRADE IN PROVIDENCE, R. I.

THE past ice season has not been satisfactory. We are not prepared just now, perhaps, to give all the causes therefor, but believe the following to be the principal reasons for much of the poor business: In the first place, it was a cool summer with us—some hot days, to be sure, but no consecutive hot weather; secondly, a full crop of ice was housed last winter, which, with the large number of small dealers here, caused the price of ice to be very low; thirdly, the hard times no doubt affected the trade somewhat, although not as much as it would if ice had been scarce and higher in price. "Last, but not least," we must lay some of the shortage in trade to the World's Fair. It is safe to say that for the last twenty weeks 100 of our families (speaking of our trade alone) have closed their houses, or the same as 2,000 families for one week, which, at an average of $1 per week, makes us short about $2,000 for this reason alone. There may be some minor causes which we have overlooked, but we believe the two principal ones to be—the cool summer and the World's Fair. As to the last named, we are, we think, patriotic enough to "take off our hats" to Chicago, and console ourselves with the fact that you have had the greatest "fair" that the world has ever seen.

Earl Carpenter & Sons.

TRADE IN GRAND RAPIDS, MICH.

THE present season's business has been all we could expect, so far as the quality of ice, trade and collections are concerned. Our local combination was well lived up to, but our prices were too low. The lake from which we cut our ice is about four miles from the center of the city, and the ice all has to be hauled to the city. Our price for family delivery was $1.50 per month for 25 lbs. daily on walk, and $2.25 put in box; for full wagon loads on walk, $1.75 to $2.00, 25 cents extra for putting in. At these prices there has been practically no money in the business this season. We have six companies in the field, which is about four more than this town can stand. As the expense of delivering is very heavy, we are now considering the advisability of districting the outskirts of the city, and will probably make a slight advance in prices for the coming season, which will probably put business on such a basis that we will receive a fair percentage on our investments.

S. P. Bennett Fuel and Ice Co.

TRADE IN CINCINNATI, OHIO.

THE ice trade here has not been a paying business this season, nor have the dealers made much money during the past three years. Competition has been strong, and the summer was not hot enough to create a heavy demand. This year July was a fair month and quite warm, but August was rather cool, with colder nights, and sales fell off 25 per cent. September was no improvement on August. The "combine" so much talked about still "hangs fire," but an agreement to maintain rates was agreed upon, and there was no "cutting in prices." The rate was low. None of the dealers have made anything worth mentioning; and it is attributed to the "hard times," the cool weather, a very late spring and an early fall (short season, in other words). Considerable natural ice will be carried over. The reports that ice manufacturers would "combine" is a "fake"; there is no probability of it. The parties interested in the old "combine" of last spring are still negotiating, but with little prospect of making it "a go." The property was appraised then, and we learn that there will be a meeting next month to definitely settle the matter one way or the other. Should they fail to agree, then there will be a "fight, square from the shoulder," that will terminate only when the combatants have "turned their toes up [financially] to the daisies," or, at least, the weaker ones. There will be no quarter shown, and a "generous public" will enjoy it and also profit by it. As we are of the latter class, we are not going to "kick." *Anon.*

TRADE IN CHARLESTON, S. C.

THERE are three dealers in ice, two in manufactured and one in natural ice. Prices are as follows for ice delivered: 2,000 lbs., $6; 1,000 lbs., $3.50; 500 lbs., $2; 100 lbs., 40 cents; 50 lbs., 25 cents; 25 lbs., 15 cents; 15 lbs., 10 cents; 7 lbs., 5 cents. The trade, on account of the comparatively cool summer, but more especially on account of the operation of the state Dispensary law, has been considerably less than in most years. *X. L.*

TRADE IN FORT WORTH, TEX.

THE situation here can be summed up in a very few words. This town is amply supplied with facilities for manufacturing ice. There are here two breweries, one

packery and one ice factory, all making ice, which, of course, necessarily gives this market a surplus. The breweries and packery have gradually drifted into a rate war, which resulted in wholesale prices going down to a point where there was no money in the business. They sold to any and everybody who wished to buy, and in any quantity, from 100 pounds to a car load at the same uniform price per 100 pounds. The result was that nearly everybody who could "rig up" an old farm wagon and borrow from his friends and neighbors a "broken down" span of old horses or mules, started in the retail ice business, selling ice for anything they could get, and as a natural consequence demoralized the retail trade so that there was little money to be made by the legitimate dealer who had his investments in the business. Owing to break downs in some of the machinery, and a spell of excessively hot weather, there was a shortage in the supply for several days. Some of the retailers were not very slow in taking in the situation, and "up" went their prices to as high as $1.50 per hundred, while before the shortage they were as low as thirty cents and thirty-five cents per 100. Two points were demonstrated by this state of affairs: *First*, the public is not fairly served by parties who have nothing at stake and who are only in the business for the money there is in it "now." *Second*, the business cannot be conducted profitably without some system or concerted action by both manufacturers and dealers, especially if the ice is being manufactured by diversified interests. There is good reason to believe that such a state of affairs will not be repeated; at any rate, we hope so, as it must be patent to all the manufacturers, by now, that money cannot be made in that way in the ice business. *M. W. L.*

THERE is a serious depression in the Maine ice business," says an Augusta writer, "which, while not perhaps originating in the same causes that have affected other lines of industry, is keenly felt in the Kennebec section where the large bulk of the ice is secured. At the close of the season, over half, and one gentleman says two-thirds, the crop harvested last winter will be left in the houses. An unusually large amount was cut, nearly every house being filled to its entire capacity, which means that something like 500,000 tons remain, a larger quantity than was ever carried over in one season on the Kennebec. The Knickerbockers will have the largest amount, as they have been running but one crew whereas in other seasons they have had four. They have obtained their supply largely from houses near the point of consumption. Morse will also carry over much ice, and the Haynes & DeWitt Co.'s northern houses at Iceboro will remain filled, although they will have emptied their others. The slack demand for the Maine product is ascribed to the cold winter which enabled operators further west and south to put up a large quantity. The failure to ship as heavily as usual has had a depressing effect in various directions. The number of men required in handling ice has been largely reduced, a circumstance which has been appreciated along the river; and furthermore, the houses being partially filled, operations on the river next winter must be a great deal smaller than in past years."

THE season closed early, November weather being felt, in the west, at least shortly after the middle of September, with but few successive warm days thereafter. The Chicago city trade has continued fair up to this date on account of the Exposition, but with that exception the season is practically over.

NATURAL ICE NOTES.

——J. S. Kimball will build an ice house at Hopkinton, N. H.

——Jacob Bonnycastle will build an ice house at Bellaire, Ohio.

——Dr. Belden is building an ice house at Chesterfield, Mass.

——Amos Bennett, Manchester, N. H., will enlarge his ice house.

——Hagen & Coogan's ice houses at Lincoln, Ill., will be enlarged.

——An addition will be built to the ice house at Flemingville, N. Y.

——The Escanaba (Mich.) Ice Co. will carry over about 600 tons of ice.

——J. B. Smith is building an ice house 40×68 feet in size at Mt. Carroll, Ill.

——W. A. Hatfield will build an ice house 40×20 feet at Westfield, Mass.

——M. D. Lyke is building an addition to his ice house at New Castle, Colo.

——Robt. N. Boak will enlarge his ice storage capacity at Middletown, N. Y.

——An icing station for refrigerator cars will be built at Cedar Rapids, Iowa.

——The Rockport Ice Co., Camden, Me., are having their ice houses put in repair.

——It is expected that considerable additions will be built to the ice houses at Nashua, N. H.

——Lyman Martin, of Martin & Brown, Alikanna, Toronto, Canada, will erect a large ice house.

——Henry Kratz, of the creamery at Moorestown, Pa., will build an ice house 30×40 feet in size.

——John Quigley will erect a new ice house at Wilbur, N. Y., to replace the one recently burned.

——W. F. Tay, Burre, Mass., has torn down his old ice house in order to erect upon the site a larger one.

——J. F. Winkler will rebuild his ice house on South Washington avenue, Saginaw, Mich., at a cost of $3,000.

——S. W. Winders' ice houses at Sycamore, Ill., are empty, and the local creameries have to go elsewhere for supplies.

——The Cedar Lake Ice Co., Minneapolis, Minn., expect to put $5,000 into new ice houses this fall to increase storage capacity.

——The Oak Grove Ice Co., Georgetown, Mass., will enlarge capacity at Lake Pentucket, where now there is housing for 4,500 tons.

——The St. Paul Ice Co. has been incorporated at St. Paul, Minn., by Nicholas Hardy, Robt. H. Seng and Paul A. Lavallee; capital stock, $10,000.

——Wm. E. Sawyer will build another ice house at Boothbay Harbor, Me., his supply this season having been too small for the demand of the fishermen especially.

——The Kessena Lake Ice Co., Flushing, N. Y., has had a prosperous season, and will this fall build a second house, though considerable ice will be carried over.

——The Jamaica Pond Ice Co. have begun work on their large ice houses on the completion of the railroad track at Sharon, Mass. They will hold 60,000 tons.

——The Rockport Ice Co., Rockland, Me., made considerable shipments in September, but closed the season October 1, with 7,000 tons of ice to carry over out of 30,000 harvested.

——The city of Alton, Ill., is negotiating for a lease on the Biggins ice house, near the old penitentiary, and if the city is successful, the prisoners will be employed to fill it with ice next winter for the city's use next summer.

——The Dominion Ice Co., with a capital of $75,000, to manufacture and sell ice, has been incorporated at Montreal, Canada, by the Hon. H. Starnes, Hon. H. Archambault, Ald. Rainville and Messrs. Bernier and De Trois Maisons.

——The Consumers' Ice Co., Bangor, Me., who recently bought the Morse ice houses at Swan Island in the Kennebec, are improving the property. A new elevator and pier are in process of construction, while the lot is being graded for new buildings.

——J. G. Alexander, as agent for the Consolidated Street Railroad Co., Grand Rapids, Mich., has sold the company's property at the corner of Sherman and East streets, to the Grant Ice and Coal Co., for $3,000. The property is 150×154 feet in dimensions. The purchasers expect to erect ice houses on the rear of the property, with a capacity of 10,000 tons, and work on them will begin at once. Wagon sheds and barns will also be built. If the times improve next year the company intends to build a block of stores on the frontage for rent.

THE new hoof inspection plan of the agricultural department went into effect October 1, and the work has been expedited everywhere by the hearty co-operation of the packers. The inspection is compulsory, and the instructions in all cases of condemnation of cattle, swine and sheep are:

"All animals found on either ante or post-mortem examination to be affected as follows are to be condemned, and the carcasses thereof stamped with the 'condemnation' stamp supplied by the department; and the inspectors will see that said carcasses are placed in the rendering tanks of the abattoirs. The diseases specified are: 1, hog cholera; 2, swine plague; 3, charbon of anthrax; 4, malignant epizoötic catarrh; 5, pyæmia and septicæmia; 6, mange or scab in advanced stages; 7, advanced stages of actinomycosis or lumpy jaw; 8, inflammation of the lungs or of the intestines; 9, Texas fever; 10, extensive or generalized tuberculosis; 11, animals in an advanced stage of pregnancy or which have recently given birth to young; 12, any disease or injury causing elevation of temperature or affecting the system of the animal to a degree which would make the flesh unfit for human food. And any organ or part of a carcass which is badly bruised or affected by tuberculosis, actinomycosis, abscess, suppurating sore or tape worm cysts should be condemned."

Mr. Secretary Morton, in referring to the subject, recently said: "I am quite determined to give all the protection which the meat inspection laws will permit to our own consumers. There will be no let up in this respect, and any restriction in the matter of inspection will be rather in the direction of microscopical inspection, which I will endeavor to confine to such packing houses as declare their intention to ship their products to such foreign markets as exact such inspection. It is a mistake, therefore, to suppose that the extension of inspection contemplated in the order above referred to will necessitate an increase in the force of microscopical inspectors. It does not affect them in any way."

PACKING HOUSE NOTES.

——The Sioux City Packing Co. has closed its premises for repairs.

——The Armour Packing Co. will put in a meat cooler at Dubuque, Iowa, and one at Winona, Minn.

——The Cudahy Packing Co. is now killing an average of 250 hogs per day in the Los Angeles establishment.

——The machinery of Rutter & Thomas' packing house, Wilmington, Del., was damaged by a recent flood.

——L. McGregor has established an extensive meat packing establishment at Roseburg, Ore., and will ship its products to different points on the coast.

——The packing house project recently noted at Augusta, Ga., is a "go." The machinery has been secured, and operations will be pushed. Bryan Lawrence can give information.

——The Cudahy Packing Co., Milwaukee, have opened a meat depot at St. Paul, and have begun work on a two-story brick cold storage house, 125×50 feet, to be erected on Prince street, near the Omaha depot.

——It is announced that arrangements have been made between William Plankinton and the firm of Jones & Stiles, the Chicago packers, whereby this firm is to go to Milwaukee and engage in the packing business with Mr. Plankinton.

——On October 23 the beef "boners" at the works of the Armour Packing Co., Kansas City, struck because the company had refused to restore wages to the old rate for the busy canning season. No demand for a return to the old rate had been made previous to the strike.

——The stockholders of the Bourbon Stock Yards Co., Louisville, Ky., recently re-elected the board of directors as follows: W. A. Ray, C. H. Gibson, John D. Taggart, George T. Woods, George Birch, Richard Frankfort, John Cudahy. The reorganization will be effected as at present.

——The Hammond Packing Co. has let the contract for a large two-story brick building to be erected adjoining the main plant. It is intended for a box factory, and will have a capacity of 5,622 feet of flooring. The company will put all modern machinery in the building and will give work to a large number of extra men.

——The contract for the erection of the new packing house of the Tri-City Packing and Provision Co., Davenport, Iowa, was let in September last. The structure is to cost in the neighborhood of $16,000. The boiler and engine room will be built fireproof, and the rest of the structure will be of frame. The company's ice houses were erected last winter and an artesian well sunk in the spring. Work will be pushed as fast as possible until the building is completed, and active packing operations will then be begun.

——Swift & Co., September 25, opened a wholesale and retail beef depot at Detroit, Mich., under the name of Swift Bros. The building is a large, two-story structure of stone and pressed brick, finished in hardwood. Beef tracks cover the ceilings of the rooms so that the trucks can take their load to any part of the building. The cold storage room requires 250 tons of ice to preserve the large number of beeves which the firm constantly keeps on hand for their customers. There is also a separate cold storage for smoked meats, pickled tongues, etc.

——J. T. Gurney, of the Gurney Refrigerator Wagon and Market Service Co., Cleveland, Ohio, is at work to form a stock company with $50,000 capital for the purpose of selling and delivering meat to customers from refrigerator wagons, putting one wagon in each ward. They will have a central market into which they run meats by the car load. The wagons are all loaded up with ice the night before. In the morning they start out to sell meat. Mr. Gurney says his people are using the system in 100 cities, and they propose to go into Cleveland, if the local laws will permit.

——The telegraph announces that on October 13, the organization of a company composed of prominent citizens of Toronto, Canada, was begun with a capital stock of $500,000 to establish packing houses similar to the Chicago corporations which are supplying Canada with all the canned meat consumed there. It is said that the latest and best machinery that can be had will be put in, and the company expect to begin operations early in the spring. They will employ 500 men, and hope to secure a monopoly of the Canadian market by underselling the Chicago producers. In speaking of which movement, Mr. S. W. Allerton, a well known Chicago packer, said: "The amount of the capital is not more than sufficient to establish a little jobbing house for home trade. Why, some of the big packers here spend twice that much in one day for stock. There is no danger of Canada making serious competition for Chicago in the packing business."

——The new ice factory at Waldo, Fla., has been completed.

——Fred'k Learz is building an ice house at Springfield, N. Y.

——Swift & Co. are building a meat cooler at Woonsocket, R. I.

——The American Ice Co.'s house at Lime lake, Franklinville, N. Y., was blown down October 14.

——The North Star Ice Co., Des Moines, Iowa, has been incorporated by J. M. Brenton, F. A. Berond and G. Anderson. Capital, $1,500.

——The old buildings of the Jamaica Pond Ice Co., recently purchased by the city of Boston, the land to be used for park purposes, were sold October 18. The lot, which cost nearly $50,000, sold for $339, all to be removed within thirty days.

——The Pocono Ice Co., of Gouldsboro, Pa., have their ice house about completed. The main building is 100×320 feet and thirty-two feet high. The workmen are now building the tower and placing the engine for hoisting the ice from 400 acres of water, 100 acres of which is in perfect order. The company will have a first-class plant.

——On September 19, in testing the new machinery at the big ice factory of the Union Ice Co., at Redlands, Cal., the main compressor pump was carelessly started without first opening the stop cock in the by-pass, and the result was very disastrous to the machinery. The pump soon created such an enormous pressure that something had to give way, and the piston went. It blew out with such force as to knock a pillar from under a large belt wheel, letting it drop, and breaking a number of castings. This will delay the work from beginning the manufacture of ice for about two weeks. The damage is estimated at about $1,200.

OBITUARY.

——Dr. J. V. Simmons, formerly of Roanoke, Va., died October 2 at Charlestown, West Va., after a lingering illness, of heart disease. Deceased was a prominent and influential citizen of Charlestown. He was the founder of the Diamond Ice Co., of Roanoke, and was also a liberal investor in real estate here. He was about fifty-six years old, and leaves a wife, daughter and son. The burial took place October 4 in Charlestown.

——T. C. Eastman, of New York city, whose death at Tarrytown, N. Y., has been recorded by the daily press, was for many years prominently identified with the dressed beef trade of America, both domestic and foreign; and no history of that trade, or of transporting refrigerators, will be complete without more or less extended notice of his career. He was born in the year 1821, in Croydon, N. H.; and after working there for a number of years he decided to come west. He accordingly located in Cleveland, Ohio, and there entered upon that busy life and occupation which have made his name so well known His business of buying and selling cattle increased with unusual rapidity, and in 1859 he made New York his headquarters. His quick perceptions of market and crop conditions soon convinced him that there was room for American meat in England, Scotland and Ireland, and in 1875 he began exporting to those countries. His first shipment consisted of both cattle and sheep. The venture was a success, so much so that it became thereafter the main feature of his business. He formed the Eastman's Company in 1889 and was its president at the time of his death. Eastman's Limited, a company which he organized in England as an outlet for his American shipments, has meat shops in all the large towns of Great Britian and Ireland, and does an extensive business. Mr. Eastman had been a sufferer for some time from a complication of stomach troubles, and the immediate cause of his death was the rupture of a blood vessel.

TRADE NOTES.

——A. Field, Jericho, Vt., is building an ice house.

——B. F. Fuller is building an ice house at Vershire, Vt.

——W. I. Rice has built an ice house at Chesterfield, Mass.

——E. U. Richmond is building an ice house at Escoheag, R. I.

——The Gouldsboro (Pa.) Ice Co. will complete an ice house this fall.

——G. H. Ellis will build a new and larger house at Newton Center, Mass.

——Calvin R. Titcomb is building an additional ice house at Rowley, Mass.

——The Great Falls Ice Co. began shipping ice from Gardiner, Me., October 16.

——The Brockton Crystal Ice Co., Brockton, Mass., has sold its ice factory to Havenstrike & Hodges.

——The Rockport Ice Co., Rockland, Me., October 13, loaded schooner Albert L. Butler, Capt. Leland, of Boston, for Port au Prince, W. I.

——The Independent Ice Co., Gardiner, Me, made their final shipment after October 20, making 50,000 shipped and leaving 20,000 unsold in the house.

——The Boston Ice Co. has constructed a branch track from the Old Colony main line at Sharon to Massapoag lake, and has lumber on hand to erect an ice house to contain 30,000 tons of ice.

——The Morse Elevator Works, Philadelphia, were awarded a medal on elevators shown—among them passenger elevator in operation carrying visitors to the top of the Transportation building.

——John Barry has begun a suit against the Boston Ice Co. to recover $5,325, on account of alleged personal injuries resulting from breaking through a wooden scaffold on which he was engaged in loading ice.

——The Hercules Ice Machine Co., Chicago, has contracted to build a 60-ton "Hercules" ice machine for the Consolidated Ice Manufacturing Co., Philadelphia—a second order of a "Hercules" by this company.

——The Lexington, Ky., ice dealers say that there is no money in ice at the rate it sold for the past season, namely, thirty-five cents per hundred pounds, wholesale, and fifty cents per hundred pounds, retail. They claim they have made no money this year, and don't see where another ice company is going to find an opening there.

——On September 9, 1893, the entire works of T. B. Wright & Co., Philadelphia, manufacturers of re-carbonized charcoal, were destroyed by fire. They have since rebuilt and have put in their mills the latest improved machinery for the manufacture of ground charcoal, and are now in a position to supply the trade in any quantity, car loads or less.

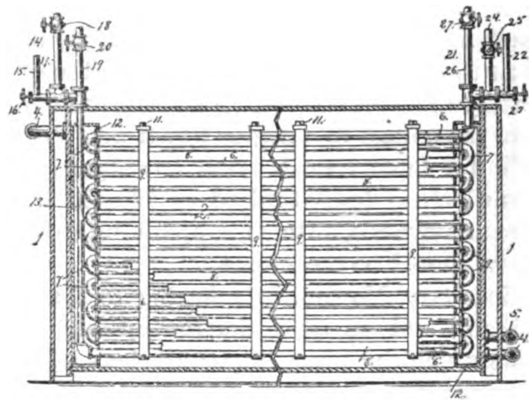
——The New York City Ice Co., of No. 409 West Twelfth street, was, October 19, dissolved by the Supreme court and Charles H. Macy has been appointed receiver. It was incorporated in May, 1875, with a capital stock of $250,000, and in April, 1891, leased its entire plant to the Consumers' Ice Co. It has ice houses at Athens and Catskill valued at $25,000 and $45,000, and three ice burges worth $29,000. The liabilities are $198,930, including $75,000 of bonds, the assets, $100,420.

We append below the most important new patents relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for ICE AND REFRIGERATION.

CONGEALER FOR ICE MAKING MACHINES.

No. 505,588. John F. Behn and Gustavus A. Wegner, Buffalo, N. Y. Filed February 18, 1890. Serial No. 340,898. Patented September 26, 1893. (No model.)

Claim.—1. In a congealer for ice making machinery hollow gas tight freezing plates consisting of a coil or succession of continuous passages through which a volatile liquid is circulated and expands, said coil or hollow plate being connected at both ends of the coil or passages to feed, suction and hot gas passages, the freezing plates being arranged within a tank at suitable distances apart, forming compartments, which compartments are filled with water and communicate with each other by short passages so arranged that the water passes from one compartment to the other at or near its bottom on one side of the compartments and passes out at or near



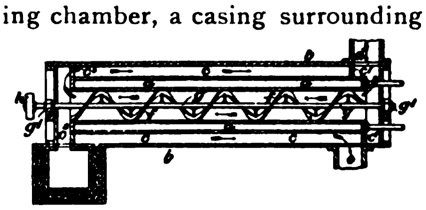
its top on the opposite side, or *vice versa*, the water being drawn from one end of the congealer and forced into the other end, substantially as shown.

2. In a congealer for ice making machinery a hollow freezing plate consisting of pipes connected by return bends, the space between said pipes being filled with close fitting strips, the whole being made rigid and bound together by clamps and the intervening spaces between said clamps, pipes and strips being filled with any conducting material that will remain insoluble in water, substantially as and for the purpose stated.

REFRIGERATING APPARATUS.

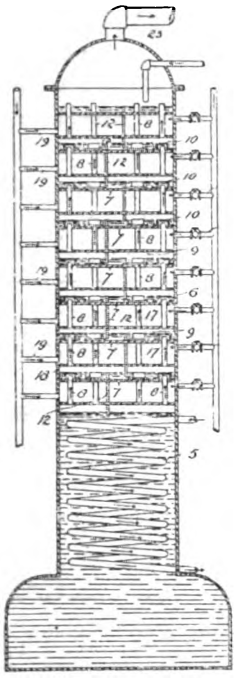
No. 505,359. Frederick B. Hill, London, England, assignor to the Hills Cold Storage Co., Limited, same place. Filed June 9, 1892. Serial No. 436,165. (No model.) Patented September 19, 1893. Patented in England December 16, 1890, No. 20,509.

Claim.—1. The combination of an annular refrigerating chamber, a casing surrounding the same and provided with inlet and outlet apertures, a rotary helical blade or conveyor which works in contact with the cylindrical wall of the said refrigerating chamber, and means for circulating air through the said casing in contact with the inner and outer walls of the said refrigerating chamber, substantially as and for the purposes above specified.



2. The combination with an annular refrigerating chamber, of a rotary helical blade or conveyor extending through the same in contact with the inner cylindrical

wall thereof, another rotary helical blade or conveyor which works in contact with the outer cylindrical wall of the said refrigerating chamber, and a chamber or casing surrounding the said refrigerating chamber and through which a cold carrier is circulated, substantially as and for the purposes specified.



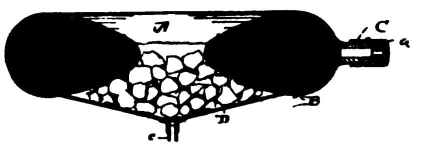
PROCESS OF PURIFYING AMMONIA GAS.

505,427. George L. Vail and Thomas Charlton, Denver, Colo. Filed March 20, 1893. Serial No. 466,770. Patented September 19. (No specimens.)

Claim.—The process herein described of purifying ammonia gas, said process consisting in passing the gas under a pressure of nine to twelve atmospheres approximately from the generating tank through a quantity of aqua ammonia at a temperature sufficiently low to remove by condensation the moisture and other impurities with which the gas is laden, the aqua ammonia containing such a per cent of ammonia gas, say from 29 to 32 per cent by weight, that it has practically or approximately reached the limit of gas absorption, substantially as described.

ICE PILLOW.

No. 505,873. Joseph Bomgardner, Wilmot, Ohio. Filed December 30, 1892. Serial No. 456,780. Patented October 3, 1893. (No model.)

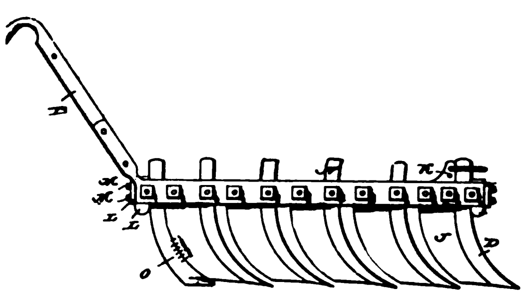


Claim. — The combination of a pillow provided with the sides *A* and *B*, the aperture *b*, an inflating tube such as *C*, the center section *D*, an ice chamber, and the drain tube *c*, all arranged substantially as described, and for the purpose specified.

ICE CUTTER.

No. 505,971. Henry Bodenstein, Staatsburg, N. Y. Filed April 3, 1893. Serial No. 468,881. Patented October 3, 1893. (No model.)

Claim—1. In an ice cutter, the combination of the frame, the handle and the teeth, the front and rear



clearing teeth curved and narrow and adjustable in the frame, the blocks bearing against the outer faces of the clearing teeth, and the clamping bolts engaging the blocks for holding the teeth at the proper adjustment.

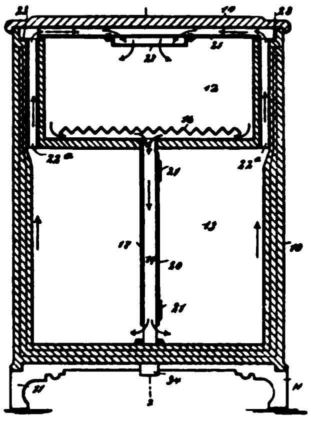
2. In an ice cutter, the combination of the frame bars, the teeth secured between the bars, the front and rear clearing teeth, the blocks bearing against their outer faces, the binding or clamping bolts engaging the blocks, and the blade contiguous to the front tooth having the extension to receive the clevis.

3. In an ice cutter, the combination with the frame bars, of the teeth secured between the bars, the front narrow clearing tooth and the rear clearing tooth having a broad foot, and means for securing the teeth at the proper place in the frame.

REFRIGERATOR.

No. 506,097. Lansing Bonnell, New York, N. Y. Filed December 17, 1892. Serial No. 455,493. Patented October 3, 1893. (No model.)

Claim.—1. In a refrigerator having an upper ice chamber and a lower provision chamber, the detachable



flues arranged at the sides of the ice chamber, and adapted to conduct the air from the provision chamber to the ice chamber, substantially as described.

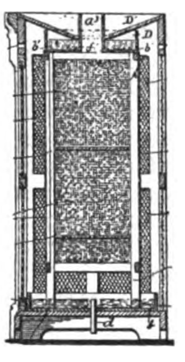
2. The combination, with the refrigerator having an upper ice chamber, a lower provision chamber, recesses in its walls opposite the ice chamber, and a space for the passage of air between the top of the refrigerator and the ice chamber, said space leading into the ice chamber, of detachable flues held in the recesses of the refrigerator, substantially as described.

3. The combination, with the refrigerator having an ice chamber in the top, a provision chamber below it, an air space above the ice chamber, and flues leading from the provision chamber to the air space, of a lid or cover for the ice chamber, having a depressed condensing box with a perforated bottom therein, substantially as described.

REFRIGERATOR.

No. 504,804. Charles H. Fox, Delano, assignor to James M. Gilstrop, Daunt, Cal. Filed June 21, 1892. Serial No. 437,537. Patented October 3, 1893. (No model.)

Claim.—1. In a refrigerator, the combination with an open framework having an opening through the top,



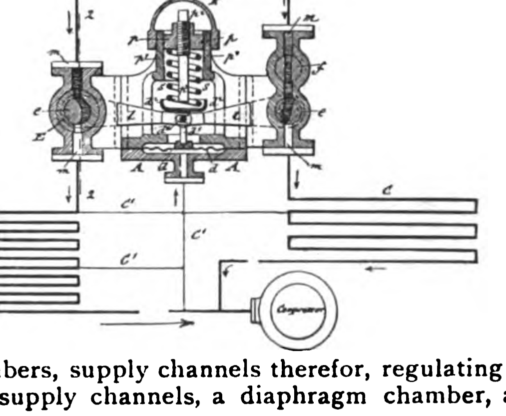
and sides composed of absorbent material, of a water reservoir arranged at the top of the refrigerator, a top board with inclining bottom located over the reservoir, said top board having an opening therein, a flue extending through this opening and in open communication with the interior of the reservoir, and means for supplying the absorbent material with moisture from the tank, substantially as set forth.

2. In a refrigerator, the combination with an outer frame, and an inner frame separated therefrom, of absorbent cloth covering the sides of said inner frame or casing, a reservoir arranged at the top of the refrigerator, a flue passing through said reservoir and communicating with the inner casing or frame, and means for conveying water from the reservoir to the absorbent cloth, substantially as set forth.

AUTOMATIC PRESSURE REGULATOR FOR REFRIGERATING MACHINES.

No. 504,092. Paul I. Schmaltz, Hamburg, Germany. Filed December 12, 1891. Serial No. 414,776. (No model.)

Claim.—3. The combination of two low pressure coils



or chambers, supply channels therefor, regulating cocks in said supply channels, a diaphragm chamber, a dia-

phragm in said chamber, pipes connecting said coils with said diaphragm chamber on one side of said diaphragm, a spindle attached to said diaphragm, levers connecting said diaphragm with said regulating cocks, a spring acting on said spindle, a threaded guide sleeve, a screw plug in said threaded guide sleeve for adjusting the tension of said spring, a stop device attached to said screw plug, and a protecting cap on said sleeve.

ONE of the most ingenious devices for a ball room decoration which has recently appeared, says London *Lightning*, is the invention of Mr. Thomas, of the Craigmillar Ice Factory. It consists in the freezing of incandescent lamps into large and prettily shaped blocks of ice, which would serve the double purpose of giving forth coolness and light.

A TOUGH TOWN.

"The toughest town in America is Mullan, Idaho," said a Boston man, who was recently telling stories over the remains of the third bottle. "Our party of three Bostonians arrived in Mullan just at dusk one day. We wanted to go right to our rooms in the hotel and get separated from the dust taken up on a long stage ride. The tavern keeper was dealing faro in the office, and we had to wait until the crowd went broke before he would even look at us. About 9 o'clock he got all the money and gave us our rooms. He took us out in the street, and pointing to a lighted room in the top corner of the hotel, said our rooms were next to that. We had to enter the house and find our beds. The landlord wouldn't walk up stairs with us, and his clerk was away acting as referee at a prize fight down at some wicked place. We were eating lunch at a table where two miners were seated, and one of the men said to his friend, 'Get on to de bloakes eatin pie wid a fork. Dey must be English lords.' Nearly every one in town had a pistol strapped on his belt, and all looked as if they were ready to start the fireworks on the slightest provocation. When we retired I asked the clerk for a pitcher of ice water. 'You ducks got nerve,' he said. 'Why?' 'Askin,' for ice water when de bar ain't closed yet. Don't serve no ice water here till de bar closes. See?' We went to our rooms, and during the night sent down stairs three or four times for a pitcher of water, but could get none. Presently a heavy pair of boots were heard on the stair, and I thought the hotel man's conscience had been creeping around. A thump on the door, and the miner who commented upon our eating with a fork pushed in his head. 'Xcuse me, pards,' he began; 'I heard you askin' for water.' 'Yes, we are very thirsty, but the hotel keeper won't give us any ice water.' 'Jim never had no heart, nohow.' 'He's a brute,' I exclaimed, feeling grateful to the kind man. 'I knowed these parts well; been here long 'fore Spokane was born, an' thought as how I might put yer onto some of de angles.' 'You are very good, sir.' 'Wal, de next time yer wants water don't bother for to send down to Jim. There's water in yer room.' 'Here?' 'Cert. There's a spring in the bed.' Then the villain slammed the door and nearly choked himself laughing."

——The Soldiers' Home, at Milwaukee, Wis., will build an 800-ton ice house.

——A stock company has been formed at Nanticoke, Pa., to build an ice factory.

——The Hercules Ice Machine Co., Chicago, are building a 3-ton ice machine to go to San Marcos, Tex.

——The Temple Ice Co., Temple, Tex., have contracted with the Hercules Ice Machine Co., Chicago, for a 20-ton ice making machine.

——The East Providence Ice Co. commenced this morning the work of digging out and covering with sand the bottom of the new pond at Riverside, R. I.

——An ice house will soon be erected on the Weed land, bordering on Crystal lake, at Greenwood, Mass. The timber has already been cleared from the land.

WANTED AND FOR SALE ADVERTISEMENTS.

[*The charge for advertisements in this column is $2 each insertion for seventy words or less, and twenty-five cents for each additional fourteen words. No advertisements will be inserted unless accompanied by the necessary cash. Parties answering these advertisements must write to the addresses given, as the Publishers decline to furnish any information concerning them.*]

For Sale.

Good second-hand ice machine, in perfect running order. Address "P. K.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Wanted.

Company with capital to control and manufacture the only perfect automatic absorption refrigeration system extant. No power used. Capacity 25 lbs. to five tons. Address "FULLY DEVELOPED," care ICE AND REFRIGERATION, 206 Broadway, N. Y.

Wanted.

Active young man, thoroughly posted in the wrought-iron pipe bending business, desires a position as bookkeeper and office man, business manager, or superintendent of shops. Best references. Address "ROGERSON," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Position as Salesman.

Wanted—a position as salesman with a good ice machine builder. Have been in the business twelve years, and have sold and helped erect some of the largest plants in the United States. Good references. Moderate salary. Address "J. H.," care ICE AND REFRIGERATION, 206 Broadway, New York.

Second-Hand Ice Machinery for Sale.

Two compression machines, one of 12-ton refrigerating capacity or 5-ton ice making, and one of 24-ton refrigerating capacity or 10-ton ice making, can be purchased for less than cost. They are guaranteed equal in every respect to the best new machines now on the market. Address for particulars, "S.W.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Sale of Nashville Ice Factory.

By virtue of resolutions unanimously adopted by the stockholders and Directors of the Nashville Ice Factory, said company has decided to go into voluntary liquidation, and the entire property of the company hereinafter described, together with its good will, will be offered for sale to the highest bidder, on the premises, in Nashville, on the 13th day of December, 1893. Said property will be sold for cash, subject to the encumbrances thereon, hereinafter mentioned, and will be offered for sale in two parcels, and afterwards as a whole, the biddings realizing the largest amount for the company to be accepted. The property to be sold consists of 135 feet of ground, located on the southeast corner of Walnut and Union streets, fronting 135 feet on the east side of Walnut street, running back between parallel lines along the south side of Union street, 161 feet to an alley. Excepting 10 feet along the Union street front, this property is covered by a brick, gravel roof building, and is used as the plant of the Nashville Ice Factory. The machinery therein consists of three Compression Ice Machines, built by David Boyle, complete in every particular; four large boilers, 60 x 16, two small pump boilers, and all pumps, tanks, cans, piping, etc., necessary to make a complete ice factory, and which is now in active operation. The ice machines are ten, fifteen and thirty tons daily capacity, respectively. The property above described is mortgaged to secure an issue of $25,000 first mortgage bonds, of which $21,000 are now outstanding, the remaining $4,000 being hypothecated to secure a loan of $3,240 of the company. Said property will be sold subject to this encumbrance. The second parcel of property to be sold consists of fifty feet of ground, fronting on Walnut street, adjoining the above described property, and covered by brick, gravel roof building, used as stables, wagon rooms, etc. Also 22 head of mules, 11 2-horse wagons, 1 1-horse ice wagon, 2 coal wagons and 1 coal cart, together with all harness, ice wagon tools, etc., complete, for handling ice. Also office furniture, consisting of safe, cash register, typewriter, desks, etc., all of which is now situated on the above described premises, and subject to inspection of all parties desiring to purchase same. The property last above described will be sold, subject to a deed of trust executed on the 25th day of October, 1893, for the purpose of securing the sum of $5,000 due by the company. Said deed of trust is registered in the Register's Office of Davidson County, in book ——, page ——, to which reference is made. Said property will be sold, subject to said encumbrances. The Nashville Ice Factory has a well established business, and a good list of customers; and its works will be kept in running order, and its business intact, until said day of sale, ready to turn over to the purchaser. Perfect title to all the property herein above described will be made to the purchaser, subject to the encumbrances above named. All communications in reference to said property, or information desired in reference thereto, should be addressed to the NASHVILLE ICE FACTORY, care of E. B. Criddle, Secretary, Nashville, Tenn. By order of the Board of Directors. W. A. ATCHISON, S. L. DEMOVILLE, R. H. GORDON, Committee.

VOL. V. NO. 6. CHICAGO : NEW YORK : DECEMBER : 1893. $2.00 PER ANNUM.

[*Written for* ICE AND REFRIGERATION.]

ARTIFICIAL REFRIGERATION IN BREWERIES.

ITS IMPORTANCE—ITS OBJECT—ITS FIRST INTRODUCTION AND SUCCESSIVE DEVELOPMENT—ITS PRESENT STATE AND FUTURE—BEER THROUGH THE AGES.

BY AUGUSTE J. ROSSI, B.S., C.E.

AMONG the numerous applications of artificial refrigeration, none has taken a more prominent place than its application to the manufacture and preservation of beer. The perfect security assured during the treatment of the liquid, and the good quality and the uniformity of the product, have justified the most sanguine expectations. There is not a brewer to-day, in the United States, at least, we dare say, who is not ready to acknowledge the countless benefits which have accrued to his industry by or may be realized from the substitution of artificial for natural cold as represented by ice. So obvious appeared the advantages to be derived from a cold obtained independently of any reliance on nature's doings and consequently to be at command at pleasure, everywhere, at any time, in the warmest climates, and at an economical price, that even from the time of the introduction of the first really practical machines for refrigerating purposes they were sought for at once for use in this business.

But such industrial machines are of a comparatively recent date. For these reasons the application of artificial cold to breweries cannot be traced much farther back than twenty-five or thirty years, at the most. Prior to that time artificial ,refrigeration was still in a state of relative infancy, and, if employed at all in breweries (as it was the case exceptionally in England) previous to that period, it was on a very small scale, and more as a trial of future possibilities. The Perkins ether machine, it is true, the first machine having any claim to that name, dates from 1835, but it was then at best but a a mere effort in the right direction, and it took some twenty years or more before Twinning and others brought it to a sufficient degree of perfection to justify its being called "industrial."

After this date, 1855–60 or thereabout, other systems were proposed and experimented upon, improvements were realized in the mechanism itself, and it was not really before 1870–75 that machines intended for the production of cold by artificial means could offer serious guarantees of regular and continuous working. Those machines, when first introduced in breweries, as we will have occasion to see further on, were intended merely to manufacture the ice used there for the purposes of brewing, whenever the natural product could not be obtained at a reasonable cost, because of location or other reasons, or wherever the climate rendered uncertain the crop of natural ice. But soon after other methods of adaptation of the artificially produced cold were suggested, and from that time (1875 or thereabout) devices of all sorts have been conceived and employed with success for the most advantageous utilization of the cold obtained.

The possibility of obtaining and maintaining uniformly by the use of machines temperatures much below those realized from the use of natural ice, has even enabled the brewer to manufacture, in conditions of absolute safety and economy, certain classes of beer of which the preparation some twenty years before was subject to many causes of failure. The introduction of refrigerating machines in breweries has given also such an impulsion to this great industry that, in the period extending from 1875 to 1890 the sale of malt liquors in the United states (see *Western Brewer* for July, 1893) increased from 8,383,720 barrels in 1875, to 26,820,953 barrels in 1890; the latter production representing a capital of over $91,000,000 and a value of products of over $100,000,000; and since that time it has been constantly and steadily increasing in a greater ratio still, the barrelage in 1892–93 having reached the enormous total of 33,876,466. It is a question which has received the greatest impetus, the brewing industry from the ice machine manufacture or *vice versa*. There cannot be any doubt, however, that the greatest improvements made in refrigerating machines were made in view of their application to breweries. Machines of dimensions and capacities unknown before and little in demand were rendered possible by the certainty of their finding immediate use, and conceptions were realized which but for their application to the brewery would have remained dormant in the minds of the inventors. At all events, one thing can be said, viz.: That whatever profit the companies manufacturing these machines may have realized in their struggle for "the survival of the fittest" the brewer has been invariably the beneficiary of the most of the improvements introduced.

We intend in the remarks following to record briefly, as far as it can be ascertained, the attempts made to apply artificial refrigeration to breweries in some sort of a chronological order, bringing forward the importance of "cold" in breweries and to enter into a general exposition of the most characteristic manner in which this artificially obtained cold has been adapted to the requirements of brewing, and has been or is now applied. We do not mean to give in detail descriptive diagrams of the contrivances alluded to, but rather to confine ourselves to a sort of schematic illustration of the different methods suggested, when found necessary to be better understood; and that as far only as they may present distinctive features, thus enabling one to judge of their desirability and justification in each case.

But in order to better understand the importance of refrigeration in general, and of artificial refrigeration more particularly, in brewing, it will not be superfluous to enter, in as succinct a manner as possible, into some consideration of the constitution of beer, stating broadly the important stages which mark its preparation, the conditions in which the liquids are treated at the stages during which certain specific temperatures are of necessity required in order to insure to the ultimate product the good qualities expected and desired.

Beer.—In those countries of the north where the grape vine does not flourish there have for centuries been prepared from certain grains fermented drinks to take the place of wine. Beer is one of these. It is, so to speak, the wine of grain. Under this generic name of "Beer" are comprised the beverages, slightly alcoholic, resulting from the saccharification of the amylaceous matters (starch) of grain, and the subsequent partial fermentation of the liquid obtained and its transformation into alcohol, in proper circumstances and under certain influences, after the addition of the aromatic and bitter principles of hops. The amylaceous substance which forms the basis of this product can be, and has been, furnished by many kinds of grains, but most generally barley has been chosen on account of the more agreeable flavor of the product obtained. However, rice has been used in India and Japan; wheat, maize, buckwheat have also been substituted for barley in certain countries; and even peas and beans have been experimented upon for a similar purpose. Beer is extensively made in France from oats, this grain containing a peculiar and agreeable aromatic principle which is imparted to the fermented product. Oat beer is known under the name of "Louvain Beer," from the name of the place where it is manufactured. In England and elsewhere the term "Beer" has been applied also in the same way to the fermented liquors made from ginger and spruce, and from the decoction of the roots of certain plants (root beer). Certain saccharine substances, such as molasses, glucose and sugar, have even been added for years to the fermentable liquid obtained from grain with more or less advantage, often for a purpose of economy.

Historical.—Many of the most important chemical facts which the ancients knew were derived from the organic branch of the science. The only acid they were acquainted with, for instance, was vinegar. Their first crude attempts at distillation were made with turpentine, an organic body. They understood the preparation of fermented liquids, such as wine from the grape; and many nations were accustomed to prepare beer from malted, or germinated, grain. Tacitus, writing at the end of the first century of the Christian era, in his treatise on the "Manners and Customs of the Germans," tells us that beer was their common drink. The text states explicitly: "They drink a liquor extracted from *barley* or *wheat*, which they submit to a process of fermentation similar to that of wine."

Pliny mentions beer as being used in Spain under the name of "Cœlia," or "Ceria"; and in Gaul under the name of "Cerevisia," or "Cererijia," in honor of Ceres, as being "the product of grain," the gift of the goddess. He goes further and states plainly that almost any kind of grains, or corn, can be used in its manufacture. These observations are fully corroborated by other writers of antiquity.

Plautus, more minutely still, calls beer "Cerealis Liquor," "a liquor used during the celebration of the solemn feasts in honor of Ceres. He and Columella, a famous writer on agriculture, writing at the time of Claudius and cotemporary of the expedition of this emperor into Britain, calls beer "Zythum," a name of Greek origin, which is interpreted as "liquor from barley."

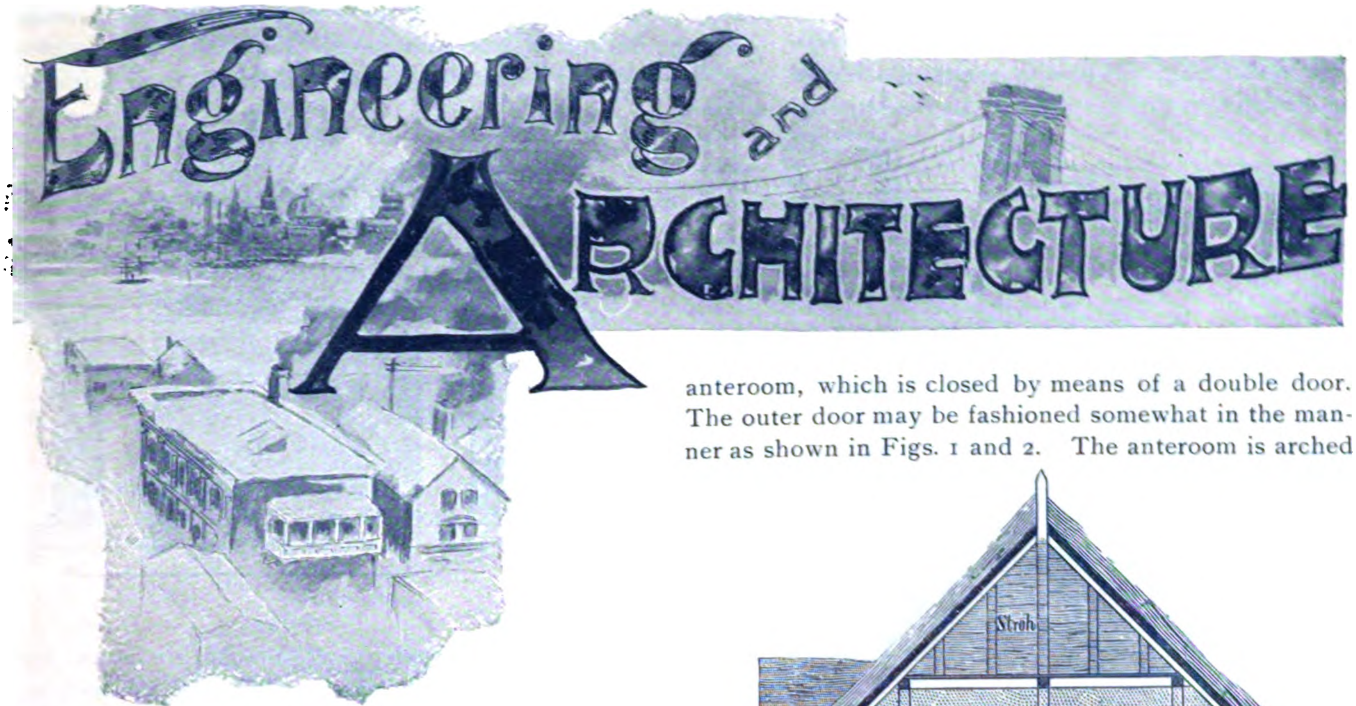
But we can trace the origin of beer to earlier times yet. The most renowned beer among the ancients, according to many writers, was known under the name of "Pelusian beverage," from the name of the antique Pelusium, at the mouth of the Nile, in Egypt, where the liquor had been prepared for "times unknown." Aristotle (354 B. C.) mentions the intoxication produced by "beer," and Theophrastus even gives it the very appropriate name of "wine of barley."

In short, authorities are abundant to show conclusively that beverages similar to our modern beers were in use among the Gauls, the Romans, the Germans, the Egyptians and most of the inhabitants of the temperate zone at the very beginning of the Christian era and for centuries before, and that it has been at all times the beverage most used and prepared in countries where wine was not abundant or where the grape was not a conspicuous product of agriculture. We are told by Mungo Park, the celebrated English traveler (1795), that in the interior of Africa the natives prepare fermented liquor from the seeds of the spiked or eared wallhardy, which is in reality a kind of beer.

[TO BE CONTINUED.]

COLD WATER REFRIGERATION.

AN Ontario, Canada, dairyman, writing to a dairy paper, says he has heard of a scheme in the states of making a cold storage by means of cold water, independent of ice. He says: "If I understand it right it was done something like this: In the first place it is necessary to have a plentiful supply of cold water, whose fountain head must be as high as the top of the cold storage. The water is conducted to a pipe which runs round the four sides of the room; this pipe is perforated on the under side, thus allowing the cold water to escape and run down the four walls continually. There is a gutter at the bottom to carry off the waste water. It is claimed that water standing at 50° will cool a room to 48°. I can quite easily understand it being cooled to the temperature of the falling water, but cannot see how it would cool it two degrees below its own temperature." The learned and ingenious milkman has propounded a "corker." Will some one elucidate?



[*Adapted for* ICE AND REFRIGERATION.]

ICE CELLARS AND ICE HOUSES.

STRUCTURES OF LIMITED CAPACITY—ICE VAULTS BUILT INTO HILLS—SMALL OVERGROUND HOUSES—ICE HOUSE FOR A RESTAURANT.

WE are frequently consulted about the construction of small ice houses calculated to keep ice during the summer months in limited quantities. In order to comply with the wishes of our patrons in this direction, we have compiled a series of sections and diagrams illus-

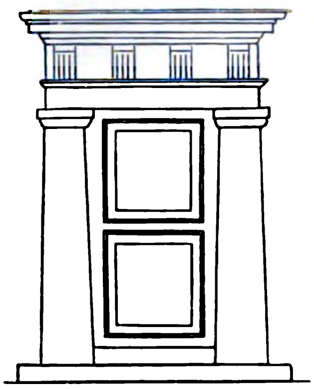


FIG. 1.

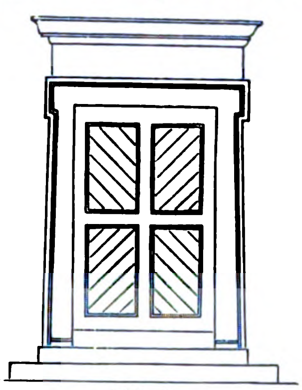


FIG. 2.

trating the construction of a variety of structures designed for the storage of ice in comparatively small quantities. These diagrams, which are reproduced on the following pages, are chiefly taken from European patterns* and their arrangement will be fully understood with the aid of the following descriptive commentary. The scales indicated under some of the plats signify meter measurement.

Figs. 1 to 6 show an ice house plant located above ground and built into a hill. Such ice houses, or "ice cellars," are very frequently found in mountainous countries, which favor their construction as a matter of course. The ice house, or vault, is provided with an anteroom, which is closed by means of a double door. The outer door may be fashioned somewhat in the manner as shown in Figs. 1 and 2. The anteroom is arched

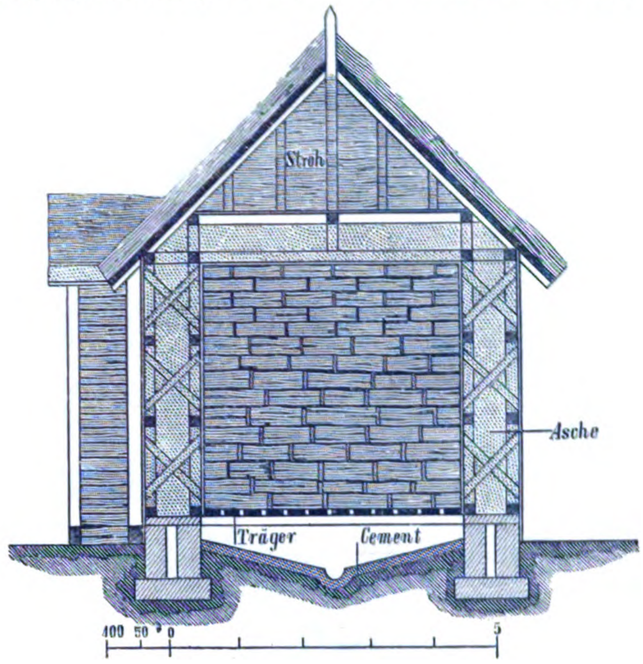


Fig. 9.

over to make it safe. The ceiling of the vault is covered with asphalt to keep out the moisture as well as the cold. The interior is coated with planks two to three inches thick, behind which are placed ashes, sawdust, straw or

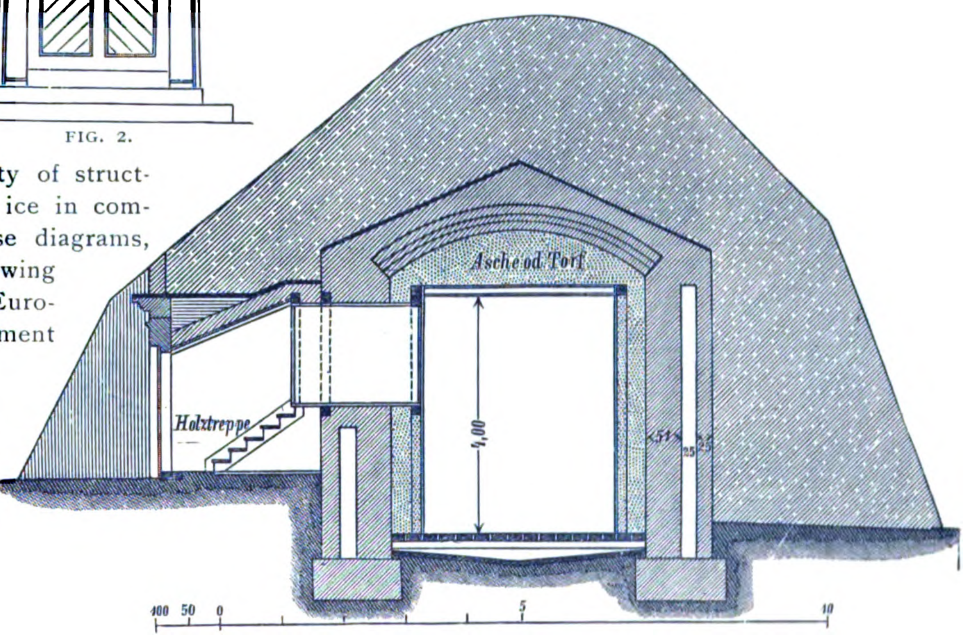


Fig 3.

other non-conductors of heat. Below the plank floor of the vault there is another floor made with cement and slanting toward one side, carrying the ice water to a

* From a recent work, "Die Eiskeller, Eishauser, Kuehbraeme, etc." By Shatteburg.

drain provided with a trap in the form shown in Fig. 5 or Fig. 6, which prevents the warm air from entering the vault. Fig. 3, showing a vertical section, and Fig. 4, showing a ground plan of the vault, explain them-

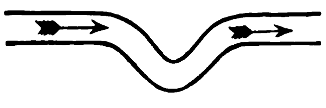


Fig 5

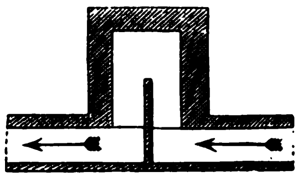


Fig. 6.

selves after what has been said already.

A similar structure, but built on a much less expensive plan, is illustrated in Fig. 7, which shows a vertical section of the same. The walls and ceiling are coated

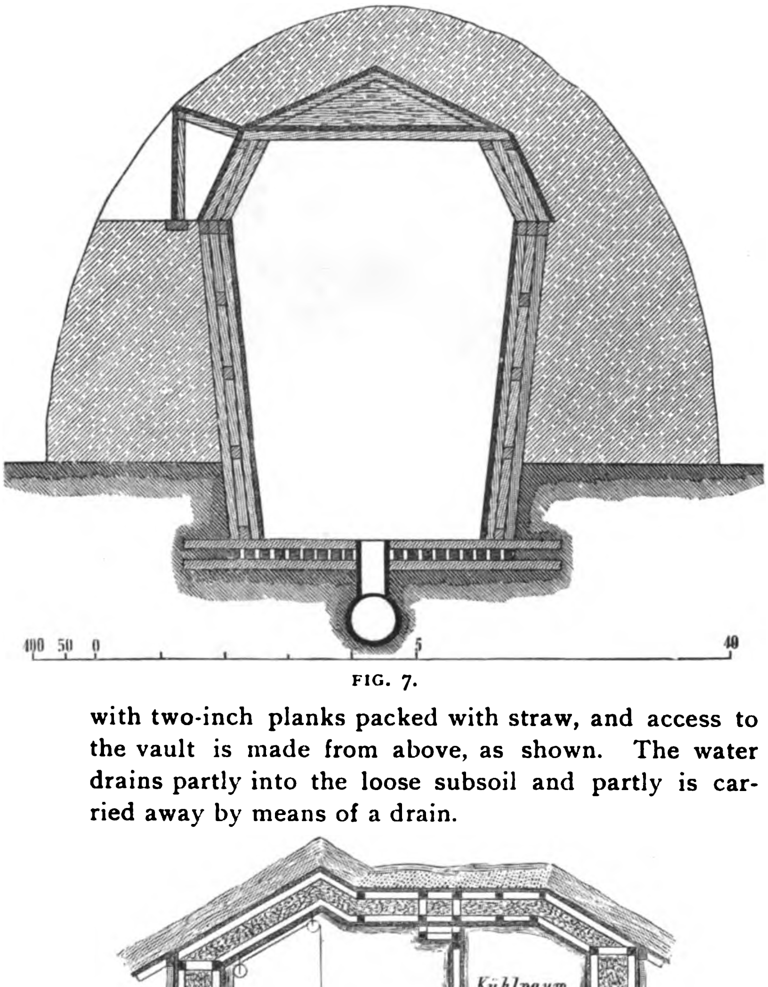


FIG. 7.

with two-inch planks packed with straw, and access to the vault is made from above, as shown. The water drains partly into the loose subsoil and partly is carried away by means of a drain.

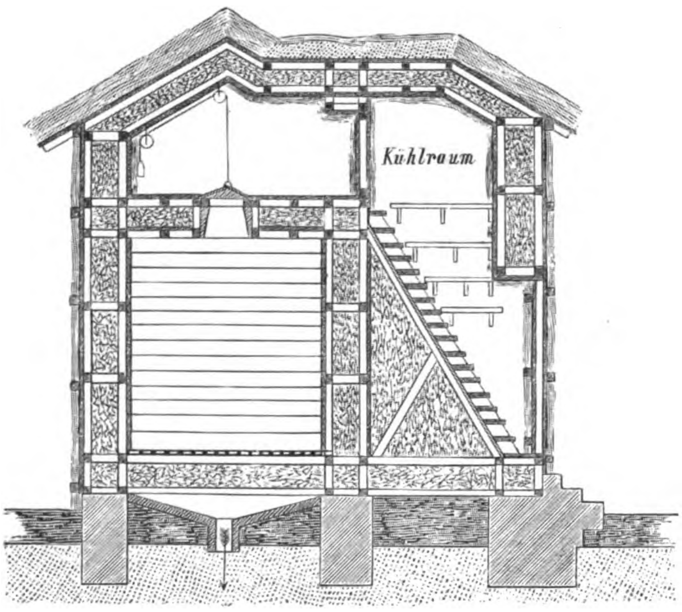


Fig. 15.

Figs. 8 and 9 show two ice houses built above ground, and constructed with pressed wood and straw and ashes as insulators. The ground plan of both houses is a square, and access to both is effected from above. The double wall of the ice chest proper is insulated by means of wood charcoal. The latter is deemed especially efficient, both as an insulator and a disinfectant for

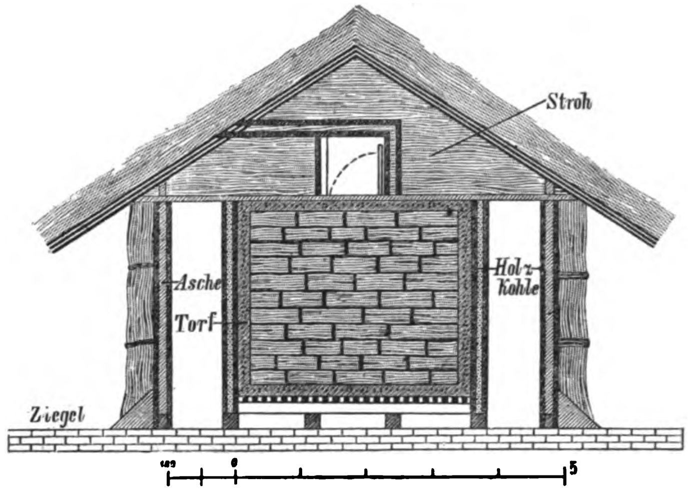


Fig. 8

stagnant air and odors. The space between the ice chest proper and the outer wall is packed with ashes. The ice house shown in Fig. 8 is covered with straw and

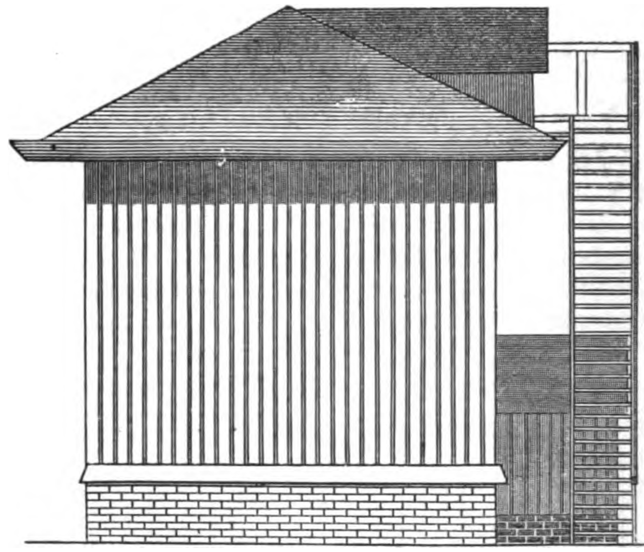


FIG. 10.

the sides are wainscoted with bundles of straw besides. Otherwise the ice house illustrated by Fig. 9 is constructed quite similar but not quite as well isolated, as it

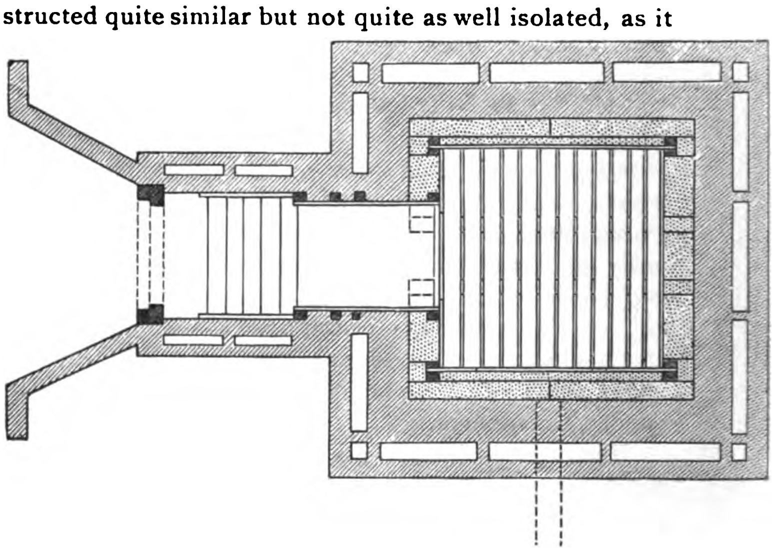


Fig. 4.

lacks the charcoal isolation of the ice chest and the outside straw lining. The entrance is effected by means of an anteroom containing a wooden stairway which leads to the opening on top.

Figs. 10, 11 and 12 show the plans of an ice house in operation at the depot at Holzminden, in Hanover, in connection with the railroad restaurant. In a general

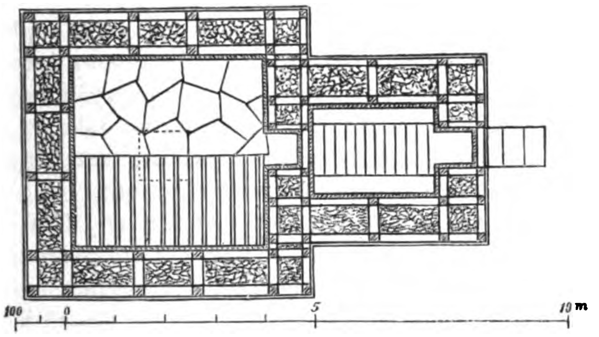
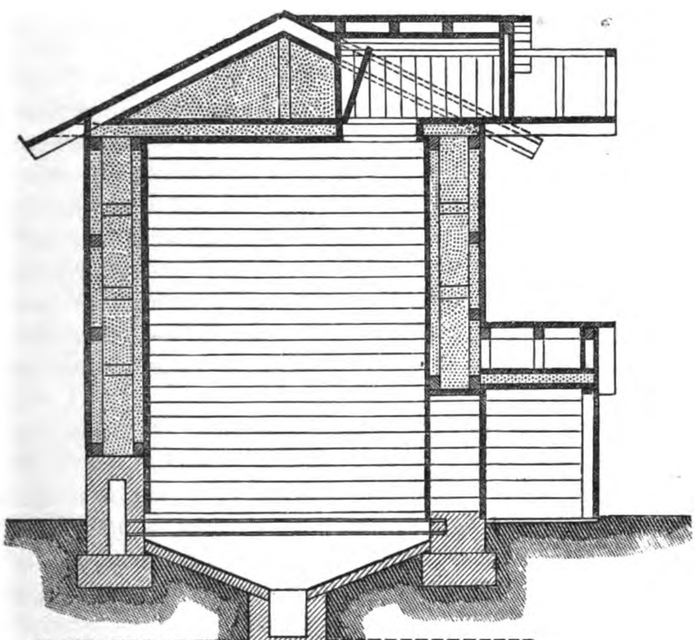


FIG. 16.

way it is quite similar to the ice house illustrated in Fig. 9, but being much higher than the latter, it is provided with two entrances, one at the top and one half

Fig. 11.



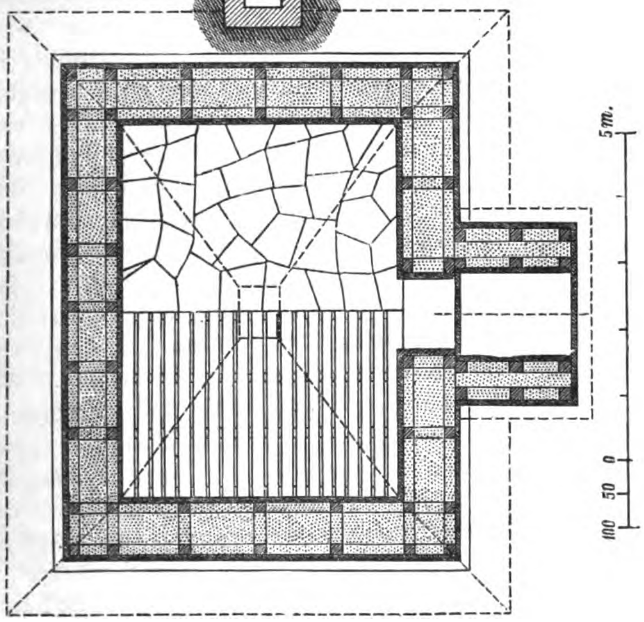


Fig. 12.

way between. Both entrances are accessible by means of a stairway in the anteroom. The foundation for the framework is made of brick. The water flows off through a drain.

A more simple plan is followed in the construction of the ice house illustrated in Figs. 13 and 14, Fig. 13 showing a sectional elevation, and Fig. 14 showing the ground plan of the same. The body of the ice chest is made of lattice work, nailed to posts which are driven

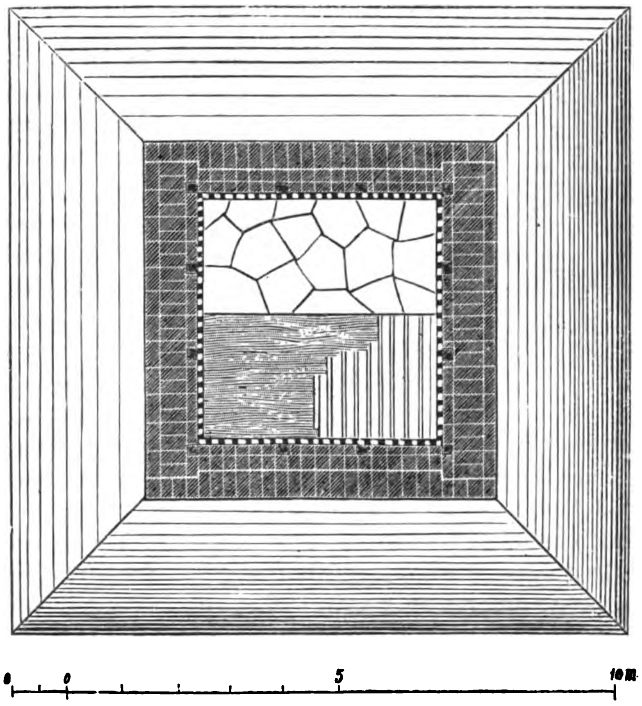


Fig. 14.

in the ground, and which are connected by cross-pieces. The isolation between the lattice work is effected by means .of peat which is braced up by a wall made of earth work. The earth is mixed with grass seed, which

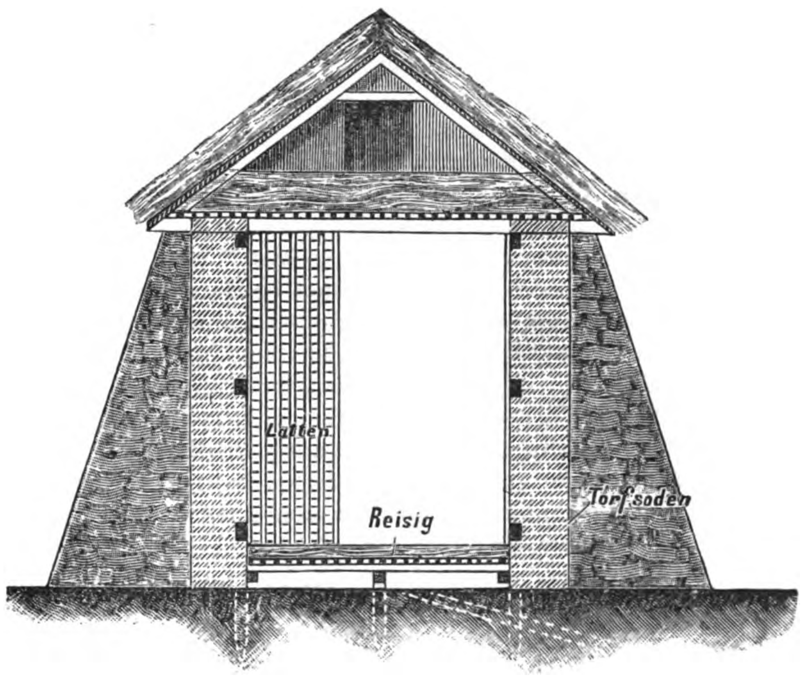


FIG. 13.

tends to make it solid in the course of time. The top is lined with boards covered with straw, besides having a straw roof also, through the sides of which access is had to the interior.

[TO BE CONCLUDED.]

——A new ice firm is soon to start in business at Mankato, Minn. It is said that the firm will supply C. G. Swanson's customers, and it is rumored that that gentleman will become manager of the business. A large quantity of ice will be secured during the winter.

[*Reprint from* The Medical Bulletin.]

ICE—HOW TO OBTAIN IT PURE.

FALLACIES ABOUT THE EFFECTS OF FREEZING AND THE OXYGENATION OF WATERS ON FLOWING STREAMS—DANGERS TO HEALTH IN BOTH WATER AND ICE.

By William R. D. Blackwood, M. D.

MANY curious delusions are held by people concerning food, and in no branch of dietetics do we hear more foolish remarks made than those referring to water and its purity. A good many well informed persons believe that if water is only clear it is therefore good in all respects; the contrary is frequently the case. So, also, with ice—a material used so commonly as to be now absolutely a necessity, particularly in cities. Most folks think that ice "purifies" itself in freezing by some mysterious process, but how it does this they can't say; sometimes they tell you that it squeezes all the impurities out during congelation, but this is not so. The truth is, that instead of doing this, during the freezing process ice imprisons many mechanical and other impure substances, and many of these foreign bodies may be very prejudicial to the health of those who consume the article in any way which carries the ice into the stomach. It is well known that many germs which are inimical to health are not killed by even long continued cold, even if the temperature is carried far below zero. Among these, it is said on good authority that the bacillus of typhoid fever is highly resistant to freezing, and, if this is so, the matter of a pure source for ice destined for drinking purposes is extremely important to denizens of cities who depend on supplies sought and obtained any or everywhere at the cheapest or the most convenient rate, usually from the nearest water course.

One of the greatest fallacies connected with the matter of potable water is the supposition that the stream purifies itself in its passage over rocks and shallow places; that "oxygenation" goes on, as the chemists have it. Such cannot be the case at all, for water cannot be oxidized without transforming it into something else than water. The fluid is H_2O, and any additional oxygen, be it one or more atoms, cannot be taken up and the fluid still remain water. To get over this difficulty, when it is advanced by those who know it, chemists and others interested in the subject then pretend that the impurities contained in water flowing in rivers, and used for drinking purposes after it is more or less saturated with the sewage of towns above the pumping stations, are oxidized; this is not so any more than in the case of the water itself. Human urine or fæcal matter, or the excrement of animals living in or outside the stream, is precisely the same, no matter how much oxygen you add to it, and oxidized urine or fæces is not fit to drink even by the most enthusiastic chemist.

Another fallacy about water is the idea that filtering it through mixtures of gravel and charcoal, or similar materials, will remove all germs from it; this is not so either, as nothing but the coarser mechanical impurities are kept back by the filters. The twigs, straws, particles of decayed fish, and other foreign matters are strained out, of course, but such material as is capable of solution in the water goes right through unchanged (including albuminoids), no matter what the apparatus may be made of. When we remember that many of the most poisonous discharges from other diseases than typhoid —for example, dysentery—are apt to be thrown into the nearest water course, this fact becomes a very important one in a hygienic aspect, if the position we take in reference to filtering be true (which we are not alarmed about in the way of successful contradiction).

So, what are you going to do about it? The only answer is: We are going to be very careful to adopt all known precautions in the way of obtaining a pure supply of water for drinking and cooking. Are you? Well, where are you going to get it? Not to speak of Philadelphia, which is furnished with water obtained from the sewer known as the Schuylkill, where is there a city in this region which does not get its water supply from a source contaminated with the sewage of the towns above it? Don't you know that every stream from which any town gets its water by pumping is fouled by the drainage of other villages or towns higher up? Is it not a fact that all communities discharge their surface drainage by gravity into the water courses in the valleys near by? Even though a city or town be set upon a hill where it cannot be hid, its sewage goes without restraint down grade to the creek or river, wherein it is hid, and whence it is drawn by hydraulic machinery for the solace and comfort on warm days of the innocent inhabitants of such places as cannot obtain enough water from the ancient system of wells for their daily uses—to their discomfort, although they may not know it, and often to their safety in the line of health.

This being so (and it is), we must do something to keep out of danger through water poisoning, which is just as dangerous as food poisoning by ptomaines; and the usual advice by those interested in such matters is to boil all the water used for cooking and drinking—a plan which is very good indeed, but very hard to follow by the busy housewife, who gets no time to do anything which is not really needed, in her view of matters. She may do this for a while, but by and by the trouble is too great, and the care needed in keeping fires going continually simply to furnish water to the family is expensive and excessive; so she quits, and the folks have to put up with the aqueous food just as it comes from the spigots, dirt and all, with the multiform microbes thrown in. This should not be, in a civilized community; yet how can we overcome the difficulty? It may be done as the writer does in his family, and here is the plan: We boil all the water required for cooking, and use melted ice for all drinking purposes invariably. All water used for culinary work is filtered through a "Globe" filter, which is quite cheap. This little apparatus is not only an inexpensive affair, but it is efficient, as it can be reversed daily to wash out the debris retained behind the flow; and one would be surprised at first to see what a lot of dirt is kept out of the water by this excellent adjunct to the kitchen supply. The affair is about the size of a small cocoanut, and is attached to the kitchen cold water spigot by a collar and binding screws. So much for one point; now for the other—the method of having actually pure ice or water for quenching thirst, or for mixing with such other beverages as you may suppose are better than plain aqua for this end.

Seeing that ice from contaminated sources, such as rivers and lakes into which drainage enters from towns and hilly regions populated more or less densely, must necessarily be impure, how are we going to solve the problem of a clean supply of ice? The answer must be, that we shall go where ice can be cut on waters into which no drainage enters. But where is this now possible? It is impossible! Every lake or pond, every river or creek, every brook or rivulet this side of the Mississippi is an open drain for the surrounding country, and, though some streams may be purer than others, none are exempt from suspicion; hence we must go farther for our answer. Where, then, shall we go?

Fortunately art is getting the better of nature steadily, and in nothing concerning the benefit of man is art further ahead (electricity alone excepted) than in this very direction. We have long heated our domiciles in cold weather by artificial means, and the day is not far distant when we shall cool them in summer with equal facility by refrigerant diffusion of force, exactly as we now light our homes and other buildings by a correlated form of force—electricity. It is just as easy to manufacture cold as it is to generate heat; brewers don't depend on storage of ice now as they did not long ago, and the principle they employ is rapidly growing for another purpose—that of the artificial manufacture of ice. Not only is ice thus made economically, but it is made in a state of purity which nature cannot approach with all its advantages.

The principle involved in the production of extreme cold by proper machinery is based on the fact that, when a suitable fluid or gas is compressed to such an extent that it becomes either a liquid or a solid, and this product is afterward permitted to expand more or less suddenly, it absorbs heat from the nearest objects which can supply it, the consequence being cooling of the subject thus affected; and as the temperature reduction thus set up may be placed at any desired point, we can either simply cool or freeze that object. Now, when nature freezes water, it does so at temperatures hovering somewhere about 32°, and not very much below that point, except in high latitudes; so the ice thus formed is not by any means so dense in texture as that which would be gotten were the temperature involved away down below zero. Practically speaking, our ice in commerce is cut in localities where the cold does not go to zero except on a few days in the winter; so we are not sure that the ice thus made is as hard as we should like it to be, and it is thus not at all an economical product, for ice not exposed to very low temperatures before marketing is much more easily melted than that gathered when the air is cold enough to "freeze the tail off a brass monkey." Of course, there is ice to be had from lakes 'way up in Maine, but all can't get this, for it comes high.

Now to the point of our paper: Under proper methods we can freeze water right in our large cities at any desired temperature ranging from 32° to any lower degree we choose, and this ice is not alone economical in being dense, but it is absolutely pure in every way—it is free from any and all germs—it is the analogue, when melted, of the few known springs in nature from which actually clean and pure water flows. This is known as "artificial ice,"—a misnomer indeed, for ice is ice, however made.

Now let us take up another point in this matter of purity of ice and water, which is the absurd idea held by persons who don't know the *rationale* of the production, and who imagine that the ice thus made contains "chemicals," as they term it. When your tyrant puts the dinner on the range to cook, she exposes the food in the pots and pans to the heat set free by combustion of the coal, and this heat is absorbed by the utensils and through them by the beef, potatoes, puddings and what not. The red hot coals don't get into the edibles, do they? Certainly not! The combustible part of the fuel liberates caloric, and this does the work of cooking, while the incombustible residue goes through the grate bars as ashes, and is thrown into the ash barrel by the careful housewife, and by the sloven over the fence into the neighbor's yard or the street. So in the case of refrigeration by machinery. The sudden expansion of compressed liquids or gases absorbs heat from the adjoining substances, and they thus liberating caloric must change their form, just as the coal does in the fire. The water thus treated, when it loses its latent heat (heat insensibly locked up in the fluid), becomes ice. The compressed material does not touch the ice at all, or the water which is frozen, any more than the fire does the canvas back in the oven. The refrigerant circulates around the outside of the pans containing the water just as the heat circulates around the exterior of the oven. The two processes are identical, but reversed in their utilization; in cooking we absorb heat from the fuel; in freezing we give away heat to the expanding refrigerant agent.

Ice made by machinery has many advantages over that cut from rivers or ponds: (1) it is absolutely pure; (2) it is much more economical at the same price than the so-called "natural ice," for, being harder, it lasts longer; (3) we don't depend on a good hard winter for our crop, for it is made actually better in the heat of summer than in winter; (4) it is uniform in its character day by day—it is not clear one day and snowy the next; and, lastly, it can be had at about the same price year by year, for the plant does not depend on Providence for cold, but it is made to order by the manager. They talk of a lady who was greatly incensed when she learned that her chunk was from a lot that had been kept over from the second winter before the dog-days during which she purchased it. If you feel that way yourself, you may be gratified to know that manufactured ice is always fresh; it is made all the time, and, by getting on the right side of the company, you can have your particular piece frozen just before the wagon starts out on its morning or evening delivery. This is surely worth something, anyhow, isn't it?

It may be asked how we know that this particular kind of ice is absolutely pure, and this is the answer: All the water used in its facture is distilled before using it: it therefore must be perfectly free from germs of all kinds, and, as heat carried to the boiling point is the only sterilizer worthy of reliance all the time and under all possible conditions, the water thus treated cannot be other than sterile, for it is not only boiled, but vaporized and condensed, after being transformed into superheated steam. In all its travels the water is carried through and by pipes and other containers which are literally clean, and into which nothing but the water to be frozen is ever permitted to enter; hence nothing for-

eign can by any possibility gain admittance into the ice, or touch it till it is taken out of the cans for disposal to consumers. As ice does not absorb air or other matters touching its exterior aspect without melting, it follows that the blocks must be pure, and a simple washing before setting it aside in the refrigerator or family ice chest will free it from any dust which may have gotten on it during its excursion from the factory to the purchaser.

Such, in brief, is the method of producing pure ice at will; many factories now exist for its manufacture, some of which are owned by companies who run down the method by sneers and misrepresentations, but who all the same keep their stock full on the sly in their houses, and who now draw ice from our northern lakes and rivers by a hundred tons, where they used to cut 10,000. In most instances, however, the sale of ice thus made is open, for those who require large quantities in transacting their business have learned that the machine-made ice is as preferable to the ordinary kind as electricity is when compared with a tallow candle.

ARTESIAN WATER SUPPLY.

A NEW feature for increasing the water supply from artesian wells was some time ago successfully introduced at New Orleans, and the recalling of the matter now may be of value to others who may desire to increase the flow of water from such wells. The New Orleans *Picayune* describes the method there employed somewhat as follows:

Many of the more extensive manufactories in the city where large quantities of water are necessary, have resorted to the use of artesian wells, and while the supply furnished has in most cases proved adequate, in some instances larger quantities than could be supplied by the driven wells were wanted. To increase the flow of water has been sometimes difficult, if not altogether impossible; but the problem has been solved, and a flow of water, from a single well, has been increased 1,000,000 gallons in twenty-four hours.

Among the fallacies regarding artesian water in New Orleans was one that it could not be used for the manufacture of ice. This was disproven by the management of the Crescent City Ice Manufacturing Co., who used it for that purpose from the first. Two artesian wells, 740 feet deep each, were driven in the yard of the factory on Front street, the first furnishing water at the rate of sixty gallons per minute, and the other eighty gallons. When the company added another 30-ton ice machine to its plant, a larger supply of water was necessary. A third driven well was determined upon, but even with this addition, should it flow at the rate of eighty gallons per minute, it would not prove sufficient for their purposes. Mr. S. J. Whitesides, vice-president of the company, then determined to venture on an experiment to increase the flow of water, and was so successful that instead of a flow of eighty gallons per minute at the surface of the ground he has secured an unremitting flow of 700 gallons per minute three feet above the surface, the water being pure, clear and sparkling, slightly impregnated with carbonic acid gas, but devoid of taste.

Mr. Whitesides found by experiment elsewhere that by cutting off the pipe twenty feet below the surface and attaching to the end a pump, the flow of water could be greatly increased, and he tried the same experiment in New Orleans. The pipe (one inch in diameter) was first driven down 740 feet, and a flow of eighty gallons per minute having been obtained. Then he stopped the flow and dug a well about thirty-five feet in circumference around the pipe, going down twenty feet and securing the sides with a brick wall. A pump with a cylinder 18×24 inches, with a plunger twenty feet long, was placed upright in the bottom of the well, and at the surface a steam cylinder 18×34 inches was placed vertically and connected with the boilers inside the building. A 6-inch discharge pipe was connected with the pump.

The "wise men in waiting" had told Mr. Whitesides that if he stopped the flow of water from the draw pipe, a sediment would form in it and choke the flow of water. The pipe had been closed a month, yet when it was opened and the pump set to work, the flow was not only as great but nearly ten times greater than it was at first. The 6-inch discharge pipe appeared to be almost too small to allow the column of water which jutted forth to escape, and the gutters in the streets were soon overflowing. For four hours steadily the water flowed, and there was no apparent diminution in the supply, nor yet were the two other driven wells, not twenty feet distant, affected by the discharge of the immense quantities of water. Mr. Whitesides says by this means a supply of 1,000,000 gallons every twenty-four hours is attainable, while by lowering the pump to a still greater depth the supply would be still larger and could readily be increased to 2,000,000 gallons in twenty-four hours.

SONGS OF THE KICKER.

Wonder if an ice man minds it when the woman of his choice looks coldly on his suit.—*Boston Transcript.*

Remarks to the ice man about wanting no more of his goods this season are nowadays greated with a cold stare.—*Ex.*

A dealer in ice thus attracted public attention to his cold commodity:

Ice! Ice!! Ice!!!
If you want it pure and n } ice
And at a reasonable pr } ice
Follow no new dev } ice
But send to me in a tr } ice
At my offi } ice

ICE IN THE PUNCH.

The wail of the 'cello is soft, sweet and low,
There are strains of romance in the thrumming banjo,
The violin's note—feel it float in your ear,
And the harp makes one fancy that angels are near.

The voice of a young girl can reach to the heart,
The song of the baritone—well, it is art,
The flute and the lute in gavotte—the guitar
In soft serenade—how entrancing they are!
But to all the mad millions
Who dance at cotillons
There's naught like the clink and the clank and the crunch
Of the ice in the punch.

So here's to the recipe, ancient in Spain,
And here's to the basket of cobwebbed champagne.
Again to the genius who grows the sharp spice,
But ten times to King Winter who furnishes ice—
For to all the mad millions
Who dance at cotillions
There's naught like the clink and the clank and the crunch
Of the ice in the punch.—*Town Topics.*

——The Galesburg Pure Ice Co., Galesburg, Ill., capital stock, $30,000, has been incorporated by W. O. Berryman, Miron Rhodes and Sol. Frohlick.

[*Abstracted for* ICE AND REFRIGERATION.]

LEGAL MATTERS.

RIGHTS AND LIABILITIES OF SELLERS OF WARRANTED ICE MACHINES—WHAT CONSTITUTES AN ACCEPTANCE —MINOR LEGAL NOTES.

IN the United States Circuit court for the Southern district of Ohio was recently decided the case of *Hercules Iron Works* v. *Dodsworth*, which is instructive on the rights and liabilities of sellers of warranted ice machines. A "Hercules" machine had been sold under a contract describing it by specifications of its various parts, which contract also contained a warranty "that the machine shall be capable of producing twenty-five tons of good, crystal, merchantable ice each twenty-four hours of continuous operation, provided it is kept in good order and properly handled, and the temperature of the condensing water is not above 60° F."

When an action was brought to recover the contract price of the machine, the answer was set up that the machine furnished had not been a compliance with the contract; that the machine furnished was not the article purchased; that the company selling it had been notified that the machine was not accepted and must be removed. It appeared beyond controversy that the machine was ready for operation about June 1, 1890; that it was operated during the summer and fall of that year; that the ice made was sold by and for the benefit of the purchasers of the machine; that in September they sent word that the machine furnished did not fulfill the contract in any respect and was not accepted, and requested its removal; that the selling company declined to remove the same, claiming that there had been a full compliance with the contract on their part, and that the machine had been accepted by the purchasers; that, after this correspondence, the purchasers continued to make ice with the machine during the remainder of September and October, 1890, and during the entire ice seasons of 1891 and 1892, and to sell the ice thus made for their own benefit. It also appeared that the machine, described by parts in the contract, had been supplied in substantial compliance with the contract. Some of these parts were claimed to be defective, but none of the defects, if they existed, were of a character which could not be remedied by repairs at a cost very small in comparison with the cost of the machine. The purchasers further strongly contended that the machine would not make twenty-five tons of ice a day, and that failure in this was a failure in identity of the article furnished with that agreed to be furnished, so that recovery could only be had, if at all, for as much as it was really worth, after the purchasers had declined to accept the machine under the contract, even if they subsequently kept and used the machine as their own.

The Court refused to take this view of the case; but charged the jury that the course of the purchasers was an acceptance of the machine under the contract, which made them liable for the contract price, but that they might recoup from that price damages of two kinds: *First*, the equivalent of the sum required to cure defects in the machine, as described by parts in the contract; and, *second*, the difference between the value of the machine producing the amount of ice per day it could produce and its value if it had been a 25-ton machine. The Court also held that it would not set aside a verdict based upon conflicting evidence of experts as to the capacity of a machine, especially when the evidence of the defeated party's experts was weakened by manifest exaggerations and inconsistencies. Besides, the company which sold the machine contended that the failure to constantly produce 25-tons a day was due to careless and improper handling of the machine, to imperfect insulation of the freezing tank, and to bad oil used in lubricating the joints, etc. It was claimed that the insulation had been rendered imperfect by a failure of the purchasers to construct a foundation in accordance with the plans and specifications furnished under the contract, and evidence was adduced tending to show this. It was also claimed that they did not buy the oil which the sellers' engineers directed them to use. Whether these causes existed, and whether they fully accounted for the failure of the machine to do its guaranteed work, the court said, were questions for the jury to decide. Many circumstances tended to show in this case that much of the trouble in the construction and operation of the machine was due to the interference of the managing purchaser, in the operation of the machine, and his stubborn views of how the machine should be constructed. operated, based on little, if any, experience in making ice.

MINOR LEGAL NOTES.

——John F. Binke, Toledo, Ohio, has sued the Wagner Lake Ice Co. to recover $15,000 damages for personal injury.

——The property of the Standard Ice Co., at Kingston, N. Y., was sold November 2 by virtue of a judgment for $38,708. Victor A. Schimmel, the bondholder, gave notice at the sale that he would loan $15,000 on the property, but finally bought it it in at $26,000.

——On October 25, at St. Clairsville, Ohio, Koehnline Bros., of Bridgport, received $1,900 damages from the Cleveland, Lorain & Wheeling Railroad Co. for their ice house, which was destroyed by fire some time ago. The fire, it will be remembered, originated from flying sparks from a passing locomotive.

——The New York City Ice Co. has been ordered dissolved by the Supreme court, and Charles H. Macy, of New York, has been appointed receiver. It was incorporated in May, 1875, with a capital stock of $255,000, and in April, 1891, leased its entire plant to the Consumers' Ice Co. It has ice houses at Athens and Catskill. Its liabilities are $190,000; assets, $100,000.

——The United States Circuit court, for the Southern district of New York, in *Bate Refrigerating Co.* v. *Sulzberger* et al., decided that "under Revised Statutes, section 4887, a United States patent expires with a foreign patent granted for the same invention to the same inventor prior to the date of the United States patent but subsequent to the application therefor."

——The Corryville Ice Co. went into the hands of H. C. Robson, secretary, as receiver, on November 17. The assets amounted to $163,000; liabilities, $43,000. The contingent liability on stock is $42,000. The application is also for a dissolution of the partnership. The direct cause is that the stockholders could not agree. It employed sixty men and sent out forty wagons.

——James and Henry F. Stevenson, proprietors of the New Independent Ice Co., Indianapolis, on October 19 filed a chattel mortgage on all the property of the company to the De Pauw University, to secure payment of two promissory notes, aggregating $15,000, which are past due and unpaid. It is provided that if the notes are not paid within ten days after the execution of the mortgage, then it may be foreclosed.

——Attachments in favor of the local creditors of Martin Mair, wholesale and retail beer dealer, ice manufacturer and proprietor of the Golden Eagle Hotel, Prescott, Ariz., were placed on his property November 2, amounting to over $9,000. The property was already mortgaged for $8,000. Its total liabilities reach between $25,000 and $30,000, and the assets will not exceed $15,000. Mair left Prescott, October 26, for San Francisco, and told his barkeeper, who is his principal local creditor, to attach the property if he did not hear from him in six days. It now appears that he never intended visiting San Francisco. His whereabouts were unknown on November 2.

JUNE BUTTER.

THE average cost of fine creamery butter on track in the west, during June, for the past three years has not been over 18 cents (except on Elgins); add freight to seaboard, four months' storage and interest, making cost about 20¼ cents in October. "Why are buyers eager to get these goods?" asks "Optimist," in the *Creamery Journal*. "Simply to do as they have done for the past three years—sell them in the fall at 25 and 27 cents, making a profit of 25 to 33 per cent. Next season will see buyers out in greater force than ever before, for their ventures have been very successful. Holding butter to-day is altogether different from what it was four or five years ago; then quality went off about as much as price went on, and after holding a few months butter became old and oily and not suited to the wants of the best trade. Ten years ago holding butter by western shippers was very common, but after a few years they dropped the practice and with it most of their money, because butter did not hold its quality. Improved refrigeration has done wonders, and the speculator to day can rest assured that his butter held frozen is 'standing up,' and if he puts away fine goods he will find the same quality when he puts it on the market. It is not expected that it will be just as fresh as when made, for it will not be so, but it will still be fine and fill the wants of almost the very best trade, and will sell to the retailer at but little under the price of fresh goods of the highest quality. Commission dealers find fault with shippers selling on track. Why they should. except that they lose the commission, is a conundrum. Granted that they may have certain trade running on certain marks. Does this help the shipper? It may make the disposal of the goods easier for the dealer, but where does the shipper come in? He gets a premium on his goods, do I hear? That is the kind of rot that makes a man tired. Fancy goods always command a premium, either in price on a quick market or a quick sale on a dull market. Notwithstanding all the kicks of the commission dealers I venture to assert that more butter will be sold 'on track' next year than ever before. One thing, however, the creamery man should insist on, and that is a regular contract signed and witnessed, setting forth in plain terms just what he is selling, and just what the buyer has a right to expect, and if it is a deal of any large amount or to cover any stated period, a bond should be insisted upon. If a bond is filed, 'quitters' will be cautious of entering into a contract."

The editor of the *Journal* is inclined to the view that "Optimist" is all right—from the speculator's standpoint: "he knows his business, that's certain." Of course he does; and he and others like him, who have invented and perfected cold storage for the purpose of speculating, have taught the producer a lesson he can, if he will, take advantage of. It has already put money in the producer's pocket, by making a better market in June for all the butter he can put out, which in years gone by was necessarily limited to the consumption in June. It is a very bad habit indeed some people have gotten into—that of accusing men (rightly or wrongly, few stop to think which) who have invented and perfected means for increasing or preserving or more cheaply handling the products of agriculture, etc., of getting an unfair share of the profits. Some may; but all the while the producer also is getting his share of the bettered conditions. Permanent "private snaps," last but a short time; things equalize themselves very rapidly; few men hold "cinches," nowadays.

A NATURAL ICE HOUSE.

ABOUT fifteen miles from Lewiston, Mont., and two miles from the Gilt Edge mine, there has been discovered a cave similar to none known in the United States, says the St. Paul *Pioneer Press*. The discovery was made by Charles Kelly, a prospector. About a week later, a party of six, equipped with miners' lamps, axes, picks, ropes and overcoats, visited the curious cave for the purpose of exploration. The party reached the entrance of the cave about 10 o'clock in the morning and immediately began their investigation.

The mouth is an irregular crevice in the sloping ledge. For a distance of about 100 feet the bottom is almost level, and the crevice widens gradually to the width of nearly fifty feet. Then there is an incline of about twenty degrees for a distance of fifty yards. Here, instead of a rocky floor, a solid body of ice was found. Fifteen minutes of hard work with the axes and picks showed that the ice was solid to the depth of more than two feet.

The party continued their journey for about three-quarters of a mile from the entrance till the widening avenues and rooms made it hazardous to proceed further, the danger of losing their way back to daylight being imminent, owing to the fact that a compass carried by one of the party had become useless on account of being affected by vast deposits of iron in the walls of the caves. Much difficulty would have been experienced in returning only for the forethought of a member of the party who marked the route taken by strokes of an ax.

The width of the cave varies at different points from 25 to 300 or 400 feet, and the roof at some points reaches within four feet of the ice and in many places is so high that it could not be seen by the light given out by the lamps carried by the explorers. At no point in the cave was any water found, only an occasional dripping from the roof. In places draughts of air were encountered that almost extinguished the lamps carried. William Armeaux has located a mineral claim at the entrance of the cave and in this way intends to secure it from the government.

FILTERING WATER.

A SERIES of investigations have for some years past been made at the water works of the city of Zurich for the purpose of testing the effect of filtration at various rates up to 3,700 gallons per square yard per twenty-four hours, with a view to ascertain whether the regulation quantity of 1,100 to 1,800 gallons to the square yard for twenty-four hours could be safely increased, or whether additional filter beds should be at once constructed to meet the constantly growing demand. The results show that, provided the filter beds are in efficient working order, neither the chemical nor the bacteriological purity of the filtered water is impaired by increasing the rate of percolation from 1,025 gallons to 2,800 gallons daily, a fact which is at variance with the commonly entertained opinion, namely, that the mean rate of percolation for sand filters should be limited to 550 gallons the square yard per twenty-four hours. These experiments have been widely quoted on account of their bearing on a much discussed question.

NEW BOOKS.

PRACTICAL INSTRUCTIONS FOR USING THE STEAM ENGINE INDICATOR. Published by the Crosby Steam Gage and Valve Co. Boston, 1893. 12mo, cloth; pp. 95. Price, $1.

Besides very exhaustive and authoritative instructions on the use of the indicator, without which an engineer can hardly work nowadays, this little book also contains comprehensive information on the use of the polar planimeter, and on Prof. Peabody's calorimeter. A second part of the work is devoted to a treatise on the generation of steam, boiler and engine tests, and to other subjects of equal importance to the engineering profession.

KLENERE SCHRIFTER UND BRIEFE VON ROBERT MAYER. Von Dr. Jacob J. Weyrauch. Stuttgart, 1893. Verlag der J. G. Cotta'schen Buchhandlung Nachfolger. 8vo, paper; pp. 498. Price, M. 10.00.

We have frequently had occasion to refer to the late Robert Mayer as the original discoverer of the mechanical equivalent of heat, he having been the first to give what was more than an approximate numerical value of the same. The general recognition of his scientific achievements, comparatively speaking, is of but recent date, and a number of Mayer's writings, which have been overlooked for years, are beginning to command the attention which should have been bestowed upon them long before. For these reasons the present work will be welcomed by all who take an interest in Mayer's labors, as it furnishes a well arranged collection of a number of his treatises, letters, day books, most of which cannot be found elsewhere, and have never been published before. This is especially true of the letters, which, besides their personal interest, offer many highly valuable suggestions and ideas in relation to the science of heat and kindred topics. The book is prefaced by a portrait of Mayer and an illustration showing his residence in Heilbronn, Germany.

WELCHE BRILLE SALL ICH WAEHLEN? By Dr. E. Jakobsohn Berlin, 1893. Verlag von Max Rockenstein. 8vo, paper; pp 16. Illustrated. Price, M. 1.00.

This pamphlet contains practical and comprehensive hints on the selection of the proper kind of glasses or spectacles, to improve the eyesight.

JAHRESBERICHT UEBER DIE LEISTUNGEN DER CHEMISCHEN TECHNOLOGIE, fuer das Jahr 1892. Von Dr. Ferdinand Fischer. Leipzig: Verlag von Otto Wiegand. 1893. 8vo, paper; pp. 1180. Price M. 24.00.

This is the thirty-eighth annual volume of this series, each volume of which gives an exhaustive review of the various branches of technological chemistry and its numerous ramifications during the preceding year. The reference to articles of food and drink, their production and preservation, including water, ice and refrigeration, alone cover a space of over 300 pages, and are a complete review of these subjects. The fermenting industries have received especial attention, there being chapters devoted to wine, beer, hops, spirits, etc. The value of the work is greatly increased by a complete bibliography given at the end of each subject treated, and also by two exhaustive indexes, occupying nearly sixty pages, one by subjects and the other by authors' names.

DE LAND'S SYNOPTICAL INDEX OF CURRENT TECHNICAL LITERATURE. Supplement to *Electrical Engineering*, an illustrated monthly magazine. November issue, 1893. Fred De Land, 565 The Rookery, Chicago. Single copies, 25c.

This most admirable *Index* is composed of 56 sheets, 42 subjects and 617 summaries—a statement that means something, perhaps much, but which is not all the truth; for apart from its size simply, the *Index* commands attention from the excellence of the development of an admirable plan. The sheets are loose and punched to facilitate binding in in order of future sheets; and the articles indexed are not simply cited by title, author and place and time of publication, but the citation includes also, in the fewest words possible, a synopsis of the argument or skeleton of the manner of treatment. The advantage to the user of the *Index* of this latter fact is obvious, for the reason that the title is too often anything but indicative of the pith of the article below it. The articles indexed under the subject "Refrigeration" are necessarily from ICE AND REFRIGERATION, as the only journal of its kind in the world; nevertheless the reader of this journal, whose tastes or business lead him into the field of engineering science or any of its multitudinous forms will find this *Index* invaluable.

WRIGHT'S AUSTRALIAN, INDIA, CHINA AND JAPAN TRADE DIRECTORY AND GAZETTEER. With Map of the World on the Mercator Projection. Geo. Wright, publisher, 121 Fulton street, New York; Watkins & Osmond, 62 Ludgate Hill, E. C., London, agents; sold by Thos. Cook & Sons' agents in New York, Boston, Philadelphia, Chicago, San Francisco, London, Bombay, Calcutta, Rangoon, Sydney, Melbourne, Adelaide, Dunedin, Wellington, Aukland. Price, $10.

As a rule, it is at best most unsatisfactory business "reviewing" a "directory," and especially directories of business men in foreign countries, which the reviewer feels by instinct, sometimes, are even more moss-grown than the almanac of the first leap year of the previous decade. In the work of circulating ICE AND REFRIGERATION during the past thirty months, however, the business management of this paper has had occasion to become somewhat acquainted with the world of ice and refrigerating machine users outside of America; and in comparing the results of our work in this line with those of the publisher of "Wright's," we are delighted to see how admirably he has covered that line of business, whence the inference is justified that it is equally faithful in all other lines. We feel, therefore, that we can commend it to the attention of our readers who are interested. The countries included are all the Australias, all South and Central American states, the Fiji, Philippine, Hawaiian, and the East and West Indian islands, Canada, Mexico, as well as the states named in the title. Each country is printed on different colored paper, with name stamped on the edge of the book and may be instantly separated from the rest of the book; and each country has its index. The Directory, besides giving a list of American and English exporters, gives a complete list of all trades and professions in the countries included, and also serves as a Gazetteer of each country, city, town or village, the latter feature making it invaluable as a ready reference for particulars of a given locality. The advertisements are placed at the end of each country, not in the body of the list. The information may be set down as reliable, the compilation having been the work of postmasters and foreign consuls resident in the various countries. The last edition has just been issued.

ILLUSTRATED CATALOGUE OF ICE MAKING AND REFRIGERATING MACHINERY. Haslam Foundry and Engineering Co., Limited. Derby, England: 1893. Cloth; square, 8mo; pp. 188.

This catalogue contains full descriptive details of the Haslam "Dry Air," De La Vergne ammonia compression, and Pontifex absorption ammonia system, all of which are supplied by the Haslam Co. Illustrations also of model installations of all types, for all purposes, on land or sea, are given, making a very interesting and valuable catalogue.

FIRE AND ACCIDENT RECORD.

——The ice house of John Bendel, in Southern avenue, Milldale, Ky., was totally destroyed by fire November 8.

——The ice house at the Lincoln, Ill., asylum for the feeble minded was burned November 3; loss, $1,500; cause of fire, unknown.

——The Housatonic Ice Co.'s buildings in Bridgeport, Conn., were entirely ruined by fire October 22; loss will exceed $5,000; cause, unknown.

——The Driggs cold storage house at Decorah, Iowa, was totally destroyed by fire about November 10; loss, about $4,000; partially covered by insurance.

——A dwelling house and ice house belonging to J. O'Connor, at Woodside, L. I., N. Y., were burned November 9; cause, believed to have been incendiary; loss, not stated.

——The seven ice houses of the Forest City Ice Co., of Fremont, Ohio, at Congress lake, was burned November 17. Some 4,000 tons of ice and packing tools were burned.

——The ice house of Weinberger & Hildebrand, at Moline, Ill., was burned, together with a tool house adjoining, October 28. The tool house contained some valuable tools. The total loss figures something like $2,000.

——James Spears' ice house at Mitchell, S. D., was burned October 23. Mr. Spears thinks the building was set on fire by tramps who have used it as a sort of rendezvous since the ice has been taken out of it. The building was insured for $500.

——E. C. Gaeckly, of Merida Yuctan, Mexico writes us that on October 16 the chocolate factory in connection with the ice factory of Senor Luis Morales, illustrated in the September issue of ICE AND REFRIGERATION, was burned. The ice plant was saved. The loss, however, was very considerable.

——The barns and ice house of John Johnston, in the town of Greenfield, Wis., were burned November 7. Several wagons and a large amount of hay and grain were destroyed, and the total loss will be about $5,000. The horses were all saved. Spontaneous combustion is believed to have caused the blaze.

[*Abstracted for* ICE AND REFRIGERATION.]

RUSSIAN LIVE STOCK.

RUSSIA AT THE WORLD'S FAIR—EXCERPTS FROM AN OFFICIAL VOLUME OF FACTS RELATIVE TO THE CATTLE AND MEAT TRADE OF THE EMPIRE.

RUSSIA'S contributions to the World's Columbian Exposition were not alone large in quantity, but exceptionally rich in the products of the fine and the liberal arts, in specimens from her mines, and in the products of agriculture; and the various exhibits were, moreover, supplemented by a fine series of volumes entitled, "The Industries of Russia," prepared under the direction of the "Department of Agriculture Ministry of Crown Domains," expressly for the Exposition, the editor of the English translation being Hon. John Martin Crawford, United States Consul-General to Russia.

Russia is so vast an empire, its area covers so wide a range of climate, its territory embraces within it so great actualities and possibilities of agriculture, grazing, etc., that its condition in these respects becomes of much more than merely passing interest to the American farmer and manufacturer of American cured or dressed meats designed for export. Russia is, and has been for many years, a conspicuous rival of the United States in the grain market of Mark Lane; only yesterday the great Standard Oil Co., than which there is no shrewder business organization in the world, announced that it had been compelled to abandon the markets in Asia and the Far East for crude and refined petroleum to Russia; it is possible that others of the great American national industries may some day be required to take Russia into the account, especially when we remember that the "range" is fast being obliterated in America, but is now being utilized in Russia on a scale which may in time affect international trade in meat and dairy products when our American methods are better utilized there.

In European Russia the raising of cattle is an important branch of farming and in its general conditions varies in the western part of Russia very little from those of neighboring countries. In the northwestern governments, in the Baltic provinces and in Finland, more attention is paid to dairy products than to fat cattle, while in the northern and central governments of the Chernoziom region both the conditions of local agriculture and the presence of the great distilleries, refineries, etc., favor the raising of stock and the production of fat cattle as a by-product of the latter institutions. The nomadic tribes, of course, subsist on their flocks and their herds, their only wealth; and "the abundance of pasture lands and the possibility of keeping the stock on green fields during long periods render steppe herding especially profitable."

Our authority, after many remarks (the kernel of interest in which, for Americans, is found in the above), then gives in a table the number of Russia's flocks and herds, from which we abstract the following:

	Horses.	Cattle.	Hogs.	Sheep.
In 59 governments in European Russia and in the Don districts in 1888 [three o's (000) are omitted]...	20,867	27,922	10,742	48,220
Finland (1889)......................	289	1,268	186	1,032
Rest of Territory	4,779	3,694	536	14,750
Total..........................	25,935	32,884	11,464	63,002

Russian cattle (and other stock), it may be remarked here, are light in weight, steppe cattle, slaughtered, weighing on the average, with fat, 17 pouds 25 pounds (1 poud = 32.243 English pounds; 1 Russian pound = 0.90282 English pound); Great Russian cattle, ditto, 7 pouds; steppe Merino sheep, ditto, 2 pouds 20 pounds; north sheep, ditto, 1 poud 10 pounds; swine, slaughtered, 7 pouds 27 pounds. The cattle of the northern and central provinces vary greatly in origin, productiveness and general quality, and for the most part are better suited to the dairy than for fattening; those of the southern districts are larger, fatten more easily and are generally better, though these too are what Americans would look upon more as dairy cattle rather than fat stock, or "feeders."

Swine are most numerous in the western and northern Chernoziom governments, the districts richest in pigs being western Russia. The predominant Russian breeds are easily fattened, the local varieties being the long-eared and short-eared swine, differing from each other but little in the main, perhaps, though the former grows larger than the latter—the average pig of the long-eared type weighing, at one year, 216 English pounds, and at two years, 360 pounds.

SALT PORK.

"Trials have been made," says our authority, "looking toward the successful export of salt pork to England and France, and although the ministry of imperial domains has done much to favor the trade, no satisfactory results have been attained, principally because the pork exported was not to the taste of foreign consumers. Until now there are so few pigs of good breeds in Russia that pork packers have great difficulty in getting a high class of pork for the market. The age of pigs slaughtered and the feed used for fattening them vary greatly on different farms.

CATTLE AND BEEF TRADE.

"The internal trade in live stock is confined to the markets and bazaars. Some dealers trade in all sorts of farm animals, and others only deal in special branches of the business. The greatest markets are in southern Russia; in those of the Don, Kouban and other governments, tens of thousands of live stock are brought together. Fattened cattle are generally sent to town to be slaughtered and the lean specimens are generally bought by stock dealers and sometimes by farmers. Cattle are fattened principally in the southwestern and southern steppes, and also in the Don, Kouban and Ural governments. The cattle and sheep of the northern breeds are seldom fed till they are fat, but are generally sold in the medium condition in the neighboring towns and villages. In winter the animals are butchered at home and their meat sent to the town markets in the frozen state. But cattle of the steppes are principally transported alive by railway. Sheep and swine are sold in very small quantities in large towns, as will be seen below. Great numbers of pigs are killed and brought into towns in winter in the frozen state, and the meat used for lard and for food in the fresh state, the latter by the poorer classes. The greatest number of the sheep which are rejected from the herd when they are from three to seven years old, are fattened for the tallow, and for preparing salt mutton. Merchants from the towns of Nakhichevan, Orenburg, Kharkov and Kazan occupy themselves with this trade. In 1890 about 845,000

head of cattle were transported by Russian railways, of which 193,958 head were taken to the Moscow market, and 119,375 to that of St. Petersburg. In the same year the St. Petersburg market received 1,773,700 pouds of meat, pork and game; the Moscow market receives a little less yearly. The number of sheep brought alive to the Moscow slaughter pens did not exceed 1,000 head, and the St. Petersburg market received only from 5,000 to 6,000 head. The average price of fattened steppe oxen has fluctuated during late years, from 85 to 113 roubles per head; of Russian cattle, from 28 to 51 roubles; of calves, from 14 to 17 roubles; of pigs, from 11 to 19 roubles, and of sheep, from 6 to 8 roubles. The town of Odessa is the great point of export of live stock. In 1888, 121,000 head of cattle, and 81,000 of sheep were brought to Odessa for sale. Warsaw is also a considerable interior market, consuming about 90,000 head of cattle and about 100,000 pouds of meat. Smaller markets, but very considerable, are Vilna, Samara, Kharkov, Kiev and Kozlov.

"At the present time meat is being transported from the farthest points of Russia in the fresh state. The meat is previously cooled and carried in refrigerator cars. The company, which transports meat from the Kouban provinces to St. Petersburg, has special cars constructed according to the systems of the engineer, Chatskine, and of the veterinary surgeon, N. Kouleshov. This method of shipping meat has great advantages over that of carrying live cattle, as the cost of transport is much reduced and the danger of exporting the cattle plague from the south is greatly lessened. In Orenburg a similar transportation company has been organized for carrying meat to St. Petersburg.

"The buying and selling of live stock on the Russian markets is at sight per head or per herd, very seldom by weight. This method is very unsatisfactory and leads often to error and trouble; therefore, many farmers have ceased to fatten cattle, for they, having less experience in valuing at sight, are often worsted by the stock dealers."

THE United States consul at Limoges, France, reports that there is a prejudice in France against both American groceries and canned meats, though many of these goods manufactured in America have been sold in Limoges as English products and marked as such. He says: "Hams, shoulders and bacon, called genuine 'Yorkshire,' were offered last year to the writer in a wholesale grocery in central France which, upon close examination, disclosed the word 'Chicago' stamped on them. The mark was faint, having been almost effaced from the meat." The consul suggests, in reference to meats prepared for export to France, that "the pieces of salt and smoked pork should not be too large. There is a great prejudice against American pork, and shippers should bear in mind that pork and ham are eaten often without being cooked." Some corned beef has been sent to France, but the sale is slow; but the consul adds: "With the prospects of meats selling at a very high price during the coming year there will be an opportunity to meet a demand that will be experienced throughout central Europe. Much attention should be paid to putting prime canned and smoked beef and beef tongues upon the European markets. If good qualities are sent over, the sales will be quick and sure.

DRESSED BEEF.

To the Editor: Can you kindly give us any information on the subject of freezing fresh meats? Our trouble seems to be that the color of the meats change to such an extent that when removed from the freezing rooms and thawed out, they are usually detected by the trade. The beef, especially the fat, or outer portion of the beef, has a tendency to bleach, not having the rich pink color which beef forty-eight hours old generally has. The ends of the cuts also change from a bright red color, known to the trade as the "Maiden blush," to a much darker color. Having been in the beef business for a number of years, and experiencing the same trouble each season, thought perhaps you might be able to give us some information on this subject, which, if an improvement, would be very valuable to us. D.

EVER since it became the practice to refrigerate beef, the "trouble" the correspondent alludes to has been noted and commented on, as no doubt it used to be commented on occasionally in mid-winter in the old days, when nature in a way did the work of the present refrigerating machine. But in the meantime no "remedy" for "the trouble" has been discovered or invented; the meat continues to bleach and the ends of the cut to dry out and darken in color.

This, in the nature of things, must continue to happen, for the phenomena noted are inseparable from the refrigeration of beef. As soon as the beef has lost the animal heat it begins to change its structure; the blood and the tissues change their form as the beef seasons, and in so changing form change color. The rich pink color of freshly slaughtered beef, "The Maiden Blush," is due to the presence of the blood in the tissues in its original form, and this bright color disappears as soon as the blood and the grain of the meat "break up," so to speak. In other words, it is practically impossible to keep beef properly for longer than forty-eight to sixty hours and preserve that bright color.

The demand of the trade or the public for meat of that color is, however, a "relic of barbarism," so to speak (and we speak advisedly), which exists, of course, but which must be "educated out" of the public mind. This bright color is always in evidence that the meat has been but recently killed, and is not thoroughly cured. In southern France, for instance, or in certain unhappy parts of our own South—where meat is killed between midnight and daylight, and the carcasses are on the block by 5:00 A. M., all sold by 8:00 A. M., and cooked by noon—the beef is always bright in color, but invariably tough and stringy, no matter what was the character of the "critter." Refrigerated beef, on the contrary, is, as a rule, tender, juicy, palatable always, because the meat has had time to season—become fit to eat, in fact. One of the most famous of the Lelands, that remarkable family of hotel keepers and caterers, we are told, make it a practice to store his meats in his refrigerators for twelve days before they were permitted to go to the roasting spit or the boiling iron—twelve days, that is, after they came into his possession, no matter how long they may have hung prior to that time; for he felt that to hold his reputation for serving fine meat he must know that his meats had become ripe under his own eye. It is safe to say that no tough meat was ever served by him.

The disintegration, so to speak, of the blood and tissue of meat in the refrigerator is a vastly different process from the change brought about by decomposi-

tion. Freshly killed meat is a great absorbent, and if not carefully treated, or, as in the old style shops, hangs for days in an atmosphere surcharged with bacterial life of every sort, decomposition very rapidly sets in, whether it is apparent or not. The meat may be bright in color, but it is all the same unfit for food, because it has not been properly seasoned; for though it may be tender, too often that is through decomposition which has done the work to be done by nature herself in disintegration in a low temperature. The shrewd housewife always hangs up her Thanksgiving or Christmas turkey in a freezing atmosphere for a week, at least—longer if she can—and a 15-pound gobbler, so treated as the *pièce de resistance* of the dinner, carves and "eats" like a morsel of the daintiest spring chicken, as tender and as deliciously flavored as a frog's leg. Beef behaves in a similar way when seasoned in the refrigerator; and it is only an ignorant prejudice—born of the habit of seeing on the block the bright colored but half seasoned beef, killed in a country slaughter house, always offensively dirty—which raises objection to a tender and wholesome quarter which may appear bleached at a fresh cut or dry and almost black at an end. These points must be taught the buyer, for it is altogether improbable that any remedy will ever be found for the loss of color mentioned.

The process of killing beef nowadays cannot be too broadly published, and attention called to the fact that it is expeditious and cleanly; that the surroundings are neat, and that as the cattle are killed they are suspended to chains, are skinned, cleaned, washed and divided in an incredibly short space of time, and that the flesh comes in contact only with the steel of the butchers. The quarters are then rolled along on trolleys to the chilling rooms, where they hang until all animal heat has disappeared. Then without having touched the floor or being in any way handled, the carcasses are rolled into refrigerators, where they are held at 36° to 38°. While thus the meat is thoroughly chilled, the nutritious juices of the meat have been retained intact; the flavor has been kept unimpaired (rather, has been perfected by wholesome development), and the white fibers in the meat have been absorbed. In a few days it is cured and ready for shipment to the retail dealer and for family consumption. The meat thus prepared by the refrigerator system is absolutely pure, and in every stage of its production has been held proof against interior corruption. It is clean, tender, juicy and palatable, the only really wholesome beef to be had, even though it may have lost "The Maiden Blush."

THE Mexicans do not use ice; nevertheless there is no country where a man can get a glass of cool, sweet water quicker than in Mexico. The water jars are made of a porous pottery which allows the water to ooze out through the material of the tanks, and the evaporation keeps it always cool. It is not cold like our ice water, but it is all the better on that account, as a man can drink twice as much and never feel in the least injured, no matter how large his draughts.

——Committees from the Consumers' and Flowerree Ice companies at Vicksburg, Miss., met in November and arranged for the consolidation of the two concerns on a basis of valuation satisfactory to all stockholders. A reorganization will be effected and stock issued on the consolidated property.

Packing House Refrigeration

THE crusade of the English stock raisers and butchers against American beef has not been an entire success. The agitation took the form of a bill to require all dealers handling "foreign meat" to so label the meat, it being supposed the label would serve as a warning to buyers that they were thus knowingly buying an inferior article. The bill was referred to a committee for investigation, and the committee in a report made public November 22, "recommends that dealers in foreign meat be registered and that a notice to the effect that they sell foreign meat be posted in their shops"; but the document also says that the United States is the principal exporter of meat to England, sending 343,573 tons to that country per year, and adds that the beef from the United States is so like English beef that the public in ninety-nine cases out of one hundred cannot tell the difference. Finally, the committee believes that a large quantity of English meat is inferior to the American product, and, in fact, it was generally asserted before the committee that the average excellence of imported meat was higher than that of home grown meat." The English butchers thus nominally win; but the great fact of the high quality of American beef is established beyond question.

FOR the summer season, ended November 1, the packing houses of Indianapolis killed 281,300 hogs, against 334,645 in the summer packing season of 1892. This is quite a decrease, but is not an unfavorable showing entirely, as it has been very difficult to get hogs, notwithstanding the extraordinarily high prices paid. The winter packing season began November 1, with two of the houses: Kingan & Co., who are killing 3,000 a day, and would kill 6,000 could they get the hogs; and the Moore Packing Co., who are killing about 400 a day, and will increase to 1,000; about November 15, the winter killing house of Coffin, Fletcher & Co. began operations. The abattoirs are killing about 300 hogs a day. The price of hogs is high. The decline in the price of hog products has considerably increased the demand.

THE new plant of the Cudahy Bros. Co., at Cudahy, near Milwaukee, started up in a tentative way November 15. Only 100 men were at work; but as soon as the machinery gets to working smoothly it is expected the full force of 1,700 men will be put to work. This new "packing town," which its owners claim will have a population of 7,000 by January 1, 1894, was a little cross-roads hamlet with a railroad station labeled "Buckhorn," surrounded by farms, in 1891, when the Cudahy brothers began looking over the ground. In 1892 they began buying up acreage right and left, but did nothing with their holdings until August, 1892, when a complete set of drawings for a $1,000,000 packing establishment was received, and a gang of men were set at work breaking ground, the first stone being laid in the wall on August 15. The two main buildings run parallel with each other, 1,200

feet long north and south, and are each 120 feet wide, with railroad tracks running between them. The full capacity of the plant is 8,000 hogs a day, but the average will be about 5,000.

THE various industries at Sioux City carried down last April by the failure of the Union Loan and Trust Co., have been reorganized by the new Credits Commutation Co., which began business November 4, with a capital stock of $7,500,000. Among the industries included in the new scheme are the Union Stock Yards Co., owner of the yards and packing houses, and the Sioux City Dressed Beef and Canning Co.

ON NOVEMBER 16 a meeting of manufacturers in various lines was held at Chicago, the object of which was to appoint an agent who will go to Japan with the purpose of increasing the purchases of American goods in that empire. Messrs. Armour and Swift, of the Chicago packing trade, have interested themselves in this movement. It is a somewhat discouraging feature in this connection, however, that a great proportion of the Japanese are Buddhists, and therefore are not meat eaters.

THE thirty-fifth year of Kansas City's record as a packing center is now drawing to a close; and Mr. J. L. Mitchener, a native of Pennsylvania, the founder of the business, still lives in the city. In 1858 he built a three-story structure at the foot of the present Forest avenue, which plant had a capacity of 600 hogs and fifty cattle daily—then a large business. For the first ten years the business grew but slowly, the kill of cattle in 1868 having been only 4,200, against 78,834 in 1893; in the same year only 13,000 hogs were killed against 1,929,826 for the last year. Mr. Mitchener's business having been closed out at the breaking out of the civil war, Mr. E. W. Pattison, who had started an establishment at Junction City, Kan., in 1867, removed it, in 1868, to Kansas City and erected the packing house which is now owned and operated by Jacob Dold & Sons. With him was associated Mr. J. W. L. Slavens, and during the first year they packed 4,200 cattle. In the same year Mr. Thomas J. Bigger, of Belfast, Ireland, started an establishment and packed for the English and Irish markets. His slaughtering was done by Pattison & Slavens, whose plant, after a number of changes of ownership, is now operated by Schwarzschild & Sulzberger Co., exporters of dressed meats. In 1870 the Armours entered Kansas City as the Armour Packing Co., and gave the packing business its first real "boom." They rented the house hitherto operated by Pattison & Slavens, and in the following year built a plant of their own. They were followed, in 1880, by Jacob Dold, who came from Buffalo, and in the following year by Fowler Bros., of Liverpool, New York and Chicago. During the two years following the coming of Dold, Fowler and the others named, Nelson Morris, Kingan & Co. and Swift came to the city and started mammoth establishments in Armourdale. There are at present eight great packing establishments in the packing district on both sides of the river, involving an investment of $16,000,000. Last year these firms bought $48,000,000 worth of hogs, cattle, sheep and calves, and sold them, it is reported, at a profit of $1,550,000. The slaughter was 1,929,826 hogs, 78,834 cattle, 249,783 sheep, and 54,700 calves. Nearly 10,000 men are employed in the packeries, and over $4,000,000 are paid in wages.

PACKING HOUSE NOTES.

——Armour & Co. are erecting a meat cooler at St. Augustine, Fla.

——The Underwood packing plant at Hutchinson, Kan., which shut down in August for repairs, has started up again.

——The cattle killing record has been broken at Armour's Kansas City packing house, 3,218 head being slaughtered in eleven hours.

——The Utica Provision and Packing Co., Utica, N. Y., has just put in a third 40-ton refrigerating machine built by the Buffalo Refrigerating Machine Co.

——The North American Packing Co. opened its house November 20, an indication that the packing situation has become a little more favorable at the Chicago yards.

——The Chicago & Eastern Illinois has reduced rates on packing house products to all points south of Kentucky and east of the Mobile bay, five cents per 100 pounds.

——The foundation for Hammond's cold storage warehouse at Spencer, Mass., is completed. The superstructure is to be of brick, one story high, and practically fireproof.

——The packing house plant of the Iowa City Packing and Provision Co. was recently sold by Receiver Neeld to Edward Tudor for $36,860. The original value of the property was $100,000.

——The Hercules Ice Machine Co. has made a contract to erect a 20-ton refrigerating machine in the new packing house of the Tri-City Packing Co., Davenport, Iowa, to be running by February 15. The Jackson Refrigerator Co. drew the plans for the plant.

——The incorporation of the Bloomington (Ill.) Pork Packing Co. has been completed. The company will buy and sell hogs, sheep, cattle and live stock and prepare the same for market. The capital stock is $1,000,000, and the principal office is to be in Chicago.

——A fire started in the pork packing establishment of Vogh & Jahke, at Sloan and Baring streets, Philadelphia, October 30, and within ten minutes the building was gutted. The structure was owned by J. Henry Jahke. Mr. Vogh places the entire loss at $25,000, covered by insurance.

——About $1,000 worth of improvements will be made at the Armour ice houses at Sugar lake, near Kansas City, at once. Among other things, they will construct a baker's oven, the Armours proposing to erect a bakery at the ice house, in order that the employes may fare better while employed cutting ice.

——J. B. Sutphin, of Duluth, Minn., made an assignment October 30 to John Flynn for the benefit of his creditors. Sutphin was formerly in the dressed meat business as J. B. Sutphin & Co., and later was interested at Duluth with the Swift Packing Co. He has lost heavily of late on account of unfortunate indorsements.

——The Knoxville (Tenn.) Butchers' Association has completed its abattoir and commenced operations. If the enterprise proves successful, the Association intends within a year to increase its capital stock to $25,000 (it is now $10,000) and arrange to start a packing department and a fertilizer factory to utilize the waste matter.

——New England Dressed Meat and Wool Co., to buy, sell and slaughter cattle in Buffalo, has been incorporated with the following directors: Norten E. Hollis, Braintree, Mass.; David N. Anthony, Fall River; Henry B. Goodenough, Brighton, Mass. Gustavus F. Swift, T. A. Adams and Arthur J. Sharp, New York; Edwin C. Swift, Lowell, Mass.; capital, $10,000.

——The directors of the International Packing and Provision Co., Chicago, have declared the usual semi-annual dividend on the preferred shares. This dividend was payable November 10. There was at one time some question in regard to its payment, but it was finally decided that in view of the favorable outlook for the packing business the declaration of the full dividend on the preferred shares was justified.

——A telegram from Toronto says that several prominent citizens of Canada have applied to the Dominion government for incorporation as the Canadian Meat and Packing Co. with a capital stock of $250,000. The head office of the company will be in Toronto and abattoirs will be erected at several points in Manitoba and the northwest where the slaughtering and packing will be done. The company claims it will make a big effort to capture the entire Canadian trade and to make large shipments to the European markets.

——Wm. J. Wulff, of the Denver Packing Co., some weeks ago purchased a number of cattle, which he has experimentally been fattening on a diet consisting chiefly of sugar beets. In the old country, Mr. Wulff says, sugar beets are fed to cattle with great success, and he sees no reason why it should not be successful in America. He believes that the meat will be finer than the finest corn fed beef. These cattle will have remained on this feed for three months before being slaughtered for the holiday trade. The feed has been of beets hashed up and mixed with chopped hay.

——The Cudahy Bros. Co., a close corporation, has been organized by Patrick Cudahy, Thomas Connell and George A. Adlam, the capital stock being $2,000,000. The company will succeed to the beef and pork packing business of Cudahy Bros., and the location of the new corporation is at the suburb of Cudahy. The members of the old firm of Cudahy Bros. were Patrick and John Cudahy. Patrick Cudahy is also one of the incorporators of the new company. The other incorporators, Thomas Connell and George A. Adlam, are employes of the firm of Cudahy Bros. Mr. Connell is superintendent of the packing house and Mr. Adlam is employed as correspondent in the general offices.

——Santa Barbara, Cal., *Independent:* "The first Hardy refrigerator car to be seen in this section arrived at the lower depot last night. It was taken to Ellwood to-day to be loaded with persimmons from Mr. Cooper's orchard for shipment to Chicago. The Hardy car is something new in the refrigerator service, and the inventor, Chas. S. Hardy, of San Diego, claims many improvements over the old styles. One is the folding ice boxes, which can be put into the least possible space when not in use, and consequently increases the capacity of the car for the return trips. Under ordinary circumstances, when the chests are filled the ice will last ten days, long enough for the entire trip. Mr. Hardy is in the city superintending the packing of the car, it being the first one sent out."

——George H. Webster has retired from active partnership in the firm of Armour & Co. The retirement of Mr. Webster leaves of the old partners in the firm only Philip D. Armour. Mr. Webster said last night that his action is due wholly to personal reasons. He has been ill for the last three months, and during that time has been able to give but little personal attention to business matters. Mr. Webster has been connected with Armour & Co. for more than twenty-eight years. He accompanied H. O. Armour when the latter first went to New York, and soon after became identified with the firm. At that time P. D. Armour was in Milwaukee and P. O. Armour in Chicago. Later Mr. Webster returned to Chicago. He was regarded as one of the most capable members of the firm. Once he and P. D. Armour conceived the idea of establishing in the South a company to run in opposition to the American Cotton Seed Oil Co. The project was, however, not carried into effect, but it is said that the firm of Armour & Co. succeeded in making a favorable contract for supplies with the southern company.

NEW CORPORATIONS.

THE following new companies have during the past month been licensed to incorporate. Where further information is known of them, notice is made in other departments of ICE AND REFRIGERATION:

ICE MAKING COMPANIES.

——Economy Ice Co., Baltimore; $100,000.

——The Crystal Ice Co., Indianapolis; $20,000.

CREAMERIES.

——Pierson Dairy Co., Chicago; $10,000.

——Riverside Creamery, Foxcroft, Wis.; $5,000.

——Woodland Creamery Co., Woodland, Mich.; $4,200.

——Marcy-Elgin Co-operative Creamery Co., Marcy, Wis.; $4,000.

——St. Paul Butter Co., St. Paul, Minn.; $10,000; manufacturing butter, cheese, etc.

——Loganville Butter and Cheese Manufacturing Association, Westfield, Wis.; $4,900.

MISCELLANEOUS COMPANIES.

——Hammond Beef Co., Detroit; $30,000.

——Cudahy Brothers Co., Milwaukee; $2,000,000.

——Robinson Brewing Co., Boston, Mass.; $500,000.

——Germania Malt Extract Co., San Francisco; $50,000.

——Twin City Brewing Co., Grand Rapids, Wis; $20,000.

——The Jas. Simmons Refrigerator and Manufacturing Co., Dallas, Tex.; $20,000.

——The Andrews Packing Co., Pueblo, Colo.; $75,000; to deal in fish, poultry, etc., at wholesale and retail.

——Little Giant Refrigerating Co. of Missouri and Kansas, St. Louis; $100,000; manufacturing refrigerating machines.

CONSOLIDATION.

——Negotiations have been in progress to effect the amalgamation of several of the big ice companies of Philadelphia. The companies which are likely to pool issues are the John Hancock, Commercial, Delaware and Union, and it has been stated that the big Knickerbocker plant was also in the deal. Augustus Hunt, president of the Knickerbocker Ice Co., said recently that some time ago he was told by a person interested that a movement was on foot to combine certain companies in the business. No overtures had been made to secure the Knickerbocker plant, and none would be considered. The stock of the company is held closely and is rarely on the market. Mr. Hunt thought that the concerns interested would effect a great economy by combining, without injuring his company in any way.

ICY ITEMS.

——The Nason Ice Machine Co. has sold a 5-ton refrigerating machine to Colgate & Co., soap manufacturers, New York city.

——Wellington Porter, Glasco, N. Y., has sold his dock property to Oakes, Thompson & Co., ice dealers, of New York city.

——C. R. Titcomb is building a large ice house. It is to be situated near Newburyport, Mass., in that locality of Rowley known as Dublin.

——James Stone has sold his interest in the Dunkirk retail branch of the Cassadaga Lake Ice Co. to Frederick C. Nagle, of Dunkirk, N. Y.

——Westerlin & Campbell, Chicago, have just closed a contract with the Kuebeler Brewing and Malting Co., of Sandusky, Ohio, for a 75-ton Consolidated refrigerating machine, and piping.

——The Little Giant Refrigerating Co. has been incorporated at St. Louis, Mo., with capital of $100,000, to manufacture small refrigerating machines. J. H. Vogelsang is president; Chas. J. McLaren, secretary; Chas. Sutter, manager.

——Kreiss & Stupp, of Reading, Pa., eastern agents for John Featherstone's Sons, Chicago, have made a contract for the refrigeration plant complete of P. Barbey & Sons, brewers, Reading, which includes two 65-ton Consolidated machines.

——The annual meeting of the stockholders of the Fall River Ice Co., Fall River, Mass., was held November 14. The report of the treasurer showed that the company had made a profit during the past year. The old board of officers was re-elected.

——At the ninth annual meeting of the Denver Land and Ice Co., held November 2, the old board of directors was chosen. At the subsequent election of officers, W. H. Eagleton was elected president; O. P. Baug, vice-president, and F. F. Hall, secretary and treasurer.

——The Caledonia Springs Ice Co., to harvest and sell ice in Rochester and vicinity, capital, $90,000, has been incorporated with the following directors: W. W. Barnard, Camille Forest, George A. Schilitzer, Charles F. Kimpal, Robert Wright, John J. Karle and August Boerner, of Rochester.

——The old ice house at Volant (New Castle, Pa.), which has been in use a number of years, is being torn down. It is claimed by the owners that since manufactured ice has been put on the market it does not pay to cut ice. The old ice house is one of the largest in the country.

——The stockholders of the Consumers' Ice Co., Lexington, Ky., met yesterday afternoon and declared a dividend of 20 per cent on the past season's business. It was decided to double the capacity of the plant for next year, and put on more wagons. The company sold ice during the past season at 35 and 40 cents per 100 pounds.

——Negotiations have been closed by which the plant of the Transparent Ice Co., in Georgetown, D. C., passes into the hands of new parties. Messrs. Curtis M. and Morris W. Smith and Francis H. Hallett have leased the plant from the company for five years, with the option of purchase. The plant has been idle since last August, but in the interval extensive repairs have been made, and new machinery added. When in full operation the plant has a daily output of twenty-five tons.

——The second annual meeting of stockholders of the Donaldsonville (La.) Ice Co., Limited, was held November 6 by stockholders representing 236 of the 300 shares of the capital stock. The following board of directors was elected without opposition to serve during the ensuing year: S. Goette, Jr., J. W. Gleason, L. E. Bentley, Henry C. Brand, L. A. Becnel, V. Maurin and Dr. Jno. D. Hanson. All these were on the former board, excepting Dr. Hanson, who succeeds Dr. McGalliard.

——The reorganization of the Chicago Produce Cold Storage Exchange Co., by which the business is to be taken out of the hands of a receiver, which was mentioned in a former issue, has been successful. The ground rent of the property on West Lake street and the river, 220 feet on the former, has been reduced to $18,000 a year, a saving of $27,000 annually, which was conceded by the owners of the fee because four-tenths of the dock front of an entire block is being used by the company. A fund of $100,000 has been raised among the stockholders to pay off a floating indebtedness and have about $50,000 in the treasury for operating expenses.

——An effort is being made by the stockholders of the Cottage Grove Ice Co., Cleveland, Ohio, to organize another stock company for the purpose of purchasing the old plant from the hands of the receiver and carrying on the business as before. The stockholders met to hear the reports of the men who had been employed to audit the books, which were not very flattering. The official figures showed that the concern is very deeply in debt. Then the matter of organizing a new stock company was brought up. It was discussed at considerable length. Most of the stockholders favored the plan. The receiver stated that $15,000 would purchase the plant complete at private sale. After thoroughly discussing the matter a committee was appointed, consisting of F. H. Morris, A. J. Brockett and Fred Bemis, whose instructions are to make a canvass among the stockholders and raise the necessary $15,000 if possible for the organization of a new stock company.

ICE & REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION, THE TEXAS ICE MANUFACTURERS ASSOCIATION AND THE FLORIDA ICE MANUFACTURERS ASSOCIATION.

.·. DECEMBER, 1893 .·.

RATES OF SUBSCRIPTION.

IN ADVANCE, POSTAGE PREPAID.

United States, Canada and Mexico,	$2.00 a Year
All other Countries,	3.00 "

Single copies 25 cents. Advertising rates on application to the offices. Remittances must be made by post-office orders, postal notes, international money orders, checks or drafts on New York, Chicago or London, payable to H. S. RICH & Co.

H. S. RICH — S. P. FOWLER — J. F. NICKERSON — JNO. GLENN COLLINS

H. S. RICH & CO.

PUBLISHERS,

177 La Salle St., Cor. Monroe, CHICAGO. — 206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

*** ICE AND REFRIGERATION is issued promptly on the 1st of each month. The first advertising forms go to press on the 20th and the last on the 27th or 28th. Changes in advertisements should be sent in before the 20th.

INDEX TO ADVERTISERS.

AFTERMATH OF THE FAIR.

IT is true that the World's Fair added but little, if anything, to the world's knowledge of refrigeration; yet the Exposition was nevertheless not without its value to the trade. For while it added no new facts to those already known, the Fair did serve as a distributing center of the knowledge of the science which has thus far assumed concrete form. From nearly every country of the world—certainly from every civilized nation—came official representatives of the government, specially commissioned to make a study, each of a different characteristic American industry. And we may say this was especially true with reference to the preparation of food supplies and their preservation and distribution. And these are the men who are to be the pioneers in many other lands.

The study by foreigners of these latter facts more particularly has been the means of giving the editor and publishers of ICE AND REFRIGERATION the rare pleasure of an acquaintance with students and professors of technical schools as well as other representatives of official bureaus, from, we believe, every enlightened government on earth who have come to us for information and advice in their researches. And these gentlemen have been not merely dabblers, or simply intelligent tourists seeking only a curious information as "notes" for "hack" literary work later on, but genuine students collecting information that in time will assuredly change *in toto* the system of movement of important food products through the channels of domestic and foreign trade.

In the course of the summer, therefore, the "missionary work" accomplished in this office has been not inconsiderable, but more important than that still is the wonderful increase of the permanent circulation of ICE AND REFRIGERATION in foreign lands. From Dublin to Yokohama, from St. Petersburg to Johannisberg in South Africa, in the Australias and the islands of the South Seas, may now be found readers of this journal—deeply earnest men who are studying the problem of the application of this new and truly wonderful science to the conservation, preservation and cheapening of the food products of their own land for the benefit of the millions who without its aid are now, and must ever remain, in that unhappy economic condition—remnant of barbarism—which means a feast in harvest time, and a famine in growing season. Having in mind the teeming millions of India, China, etc., can we not imagine in part the inestimable benefit the World's Fair may, therefore, yet confer on mankind through a science which was (let it be repeated) practically ignored by the Fair's management, but which was too great to escape glorification above many of its fellows.

ANSWERS TO CORRESPONDENTS.

LEAK IN COILS IN BRINE TANK—KEEPING APPLES—SIZE OF MACHINE NEEDED—WATER IN STEAM BOILERS—USE OF INDICATOR DIAGRAMS—REFRIGERATION FOR CHEMICAL PRODUCTS—LIMITS OF REFRIGERATION.

[This department of ICE AND REFRIGERATION is conducted for the benefit of the trade generally, as well as individuals; and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

LEAK IN COILS IN BRINE TANK.

To the Editor: We had a leak in one of the coils in our brine tank, which impregnated the brine with ammonia, but to what percentage I have no means of determining, but the brine gives out a strong scent of ammonia. Would you kindly let me know whether the ammonia will have any effect on the temperature, and if so, is there any way to extract the ammonia and save the brine? I. K.

ANSWER.—The ammonia which you say has infected your brine will have no influence on the temperature or the refrigerating capacity of the latter, only that the smell of the ammonia is objectionable. To restore the brine to its original condition, the same would have to be boiled, which will drive off the ammonia. Another way to get rid of the ammonia smell would be by neutralizing the ammonia by an addition of a proper amount of muriatic acid. However, as the least excess of muriatic acid would attack the iron pipes, it would be necessary to exactly determine the amount of acid needed by means of a chemical analysis of the brine. The small amount of chloride of ammonium formed in this way, we think, would do no harm at the low temperature at which the brine is kept.

KEEPING APPLES.

To the Editor: Will you kindly inform us, *first*, whether apple barrels should be ventilated when containing apples for long storage, say six or seven months? *Second*, Is it of importance that the barrels should stand on end with strips underneath, or could they be laid on their side or endwise to the same advantage while in storage? *Third*, Is it an advantage to eggs or other goods in storage to keep ordinary lime spread upon the floor? Does it act both as a disinfectant and absorb moisture? *Fourth*, We have just received several cars of New York apples which we have purchased for storage. A good number of these apples show a *dry* rot at the blossom end of the apple, about the size of a silver three-cent piece. In your opinion would this affect their keeping qualities in storage? L. E. B.

ANSWER.—*First*, It is not necessary that apple barrels should be ventilated. *Second*, They should not be stood on end, but preferably on their sides. In ICE AND REFRIGERATION for June and July, 1893, you will find other information on this subject. In general practice in this city, apples are stored in the barrels in which they arrive in market from the grower, laying the barrels on their sides and holding the temperature even at 33°. *Third*, It is in some houses here considered an advantage to eggs, and other goods in storage, to have the rooms containing them whitewashed and the floor sprinkled with lime. *Fourth*, The dry rot you speak of at the blossom end of apples is not a serious imperfection. In our opinion if the temperature of the storage room is held firmly at 33°, and is not subject to variation, the dry rot is not likely to injure the sale of the apples.

SIZE OF MACHINE.

To the Editor: I would like to ask you a question regarding the size of an ice machine. We have a room that is thirty-five feet long, thirty-three feet wide and eight feet high; another thirty-five feet long, eighteen feet wide, seven feet high; and another that is thirty-three feet long, eighteen feet wide and eight and one-half feet high; another thirty-four feet long, thirteen feet wide, eleven feet high; and kill about twenty head of cattle and 100 head of hogs a week. How large a machine would it take to do the work in ten hours, and how large a brine tank would it require for that amount of work? J. S.

ANSWER.—It does not appear very clearly from your letter whether you intend to do the slaughtering of the twenty head of cattle and 100 head of hogs in a week (six days) or in ten hours (one day). Apparently you intend to do the latter. In that case you would require what commonly is called a 20-ton machine with a brine tank 12×10×10 feet. The brine circulating pump, however, would have to run more than ten hours the day on which the slaughtering is done, while at other times five hours per day would be sufficient.

WATER IN BOILERS.

To the Editor: Our water contains a large quantity of chlorine, about six grains to the gallon. We have two boilers, one 80-horse power, and the other 40-horse power. The chlorine has corroded the interior of the 80-horse power boiler until we are troubled with small holes in the flues, while the 40-horse power is in perfect condition, and has never given us any trouble. G. T. J.

ANSWER.—Your question presents quite a riddle to us, especially as your statements are rather general. If the same water is used in the two boilers, and if they are made from the same kind of iron and are similarly constructed and carry the same pressure (and your letter states nothing to the contrary), it is difficult to understand why they should behave so differently. Whether the action is due to chlorine depends on the combination in which it occurs in the water, and if we had a full analysis of the water, or, better still, were enabled to make one ourselves, we should be in a better position to judge on this point. It is possible that your water contains much chloride of magnesium (which at a certain temperature is decomposed in the boiler), and that the boiler affected carries a pressure or temperature more favorable to such decomposition than the other, which would explain in a measure the occurrence referred to. Give a little more definite and detailed information on these points, and we will try to give you a more positive answer.

USE OF INDICATOR DIAGRAMS.

To the Editor: I would like to know if the refrigeration or ice making can be figured from a compressor indicator card. If so, will you please figure out or give me a rule, or where I can find one for the same, and return same by mail at your earliest convenience? The inclosed cards were taken from a compressor 16×42-inch stroke, running at 66 revolutions, condenser pressure, 170; back pressure, 14; spring, 100; clearance in the engine compressor, $\frac{1}{8}$ double-acting. From one of your oldest subscribers, W. P. S.

ANSWER.—In returning the indicator cards you have sent us, we must say that they are of no practical use for calculating the refrigerating capacity of your machine except in a roundabout way. These diagrams, in showing at a glance the conditions of pressure at the different positions of the piston, give a ready idea of the regularity of the working of the compressor, its valves, etc., and in this respect the diagrams submitted show rather well for your machine. Furthermore, these diagrams show the actual power spent in the compressor for the compression of the ammonia. It is represented by the superficial area of the diagram, which can be found by actual measurement of the same, or calculation, or much simpler still, by means of a planimeter which is a mechanism adapted for the mechanical calculation of curved

surfaces. With proper precautions and an accurate balance, the relative area of these diagram can also be ascertained by using boards of uniform thickness and weighing the diagrams after they have been carefully cut out. The expression of power obtained in this way as consumed by the compressor may be compared with that furnished by the engine diagrams or with the amount of coal used to produce it, etc. It is not, however, of any direct use for the calculation of the refrigerating capacity, except, perhaps, in accordance with the following considerations: Theoretically speaking, the heat carried away by the condenser water must be equal to the heat transmitted to the ammonia in the refrigerating tank, and in addition to that, to an amount of heat equivalent to the power consumed by the compressor. Therefore if the quantity of cooling water and its temperature before it enters and after it leaves the condenser is known, and if these data are converted into calorical units, we can approximately find the refrigerating effect, by subtracting from the figure obtained in this manner the number of calorics equivalent to the power used by the compressor as derived from the measurements of the indicator diagram. But, as stated already, this is a roundabout way and presupposes that the indicator diagram is absolutely correct, which is not always the case. If you had stated in your letter whether you meant absolute or gauge pressure, the capacity of your machine could be calculated more closely from the figures given than by use of the indicator diagrams. Thus if we assume that your pressures refer to gauge pressure, they would correspond to a temperature of about 0° in brine coils and to a temperature of about 91° in condenser coils, and under these circumstances the maximum theoretical effect of one pound of ammonia passing the condenser would be equal to

$$555.5-(91\times 1.1)=455.4 \text{ units}$$

in round figures, 1.1 being the specific heat of liquid ammonia. The capacity of your compressor in accordance with the figures given by you and allowing the usual amount for clearance, is about 4.5 cubic feet, and therefore the ammonia passing the compressor in twenty-four hours amounts to

$$\frac{4.5\times 66\times 60\times 24}{9.1}=47{,}000 \text{ pounds.}$$

9.1 being the volume of one pound of ammonia in cubic feet. The refrigerating effect therefore amounts to

$$47{,}000\times 455.4=21{,}403{,}800 \text{ units.}$$

This represents the maximum theoretical refrigerating effect expressed in thermal units, and expressed in tons of ice it amounts to

$$\frac{21{,}403{,}800}{284{,}000}=75.37 \text{ tons.}$$

This would be the theoretical refrigerating capacity of a single-acting compressor of the dimensions given. A double-acting compressor like yours would figure up double that amount, or about 150 tons. The practical refrigerating effect is of course considerably less and the ice making capacity still more so, as you are well aware.

REFRIGERATION FOR CHEMICAL PRODUCTS.

To the Editor: We have been informed that there are many openings for refrigerating machines in chemical manufacturing. Will you have the kindness to point out some of the branches in chemical manufacturing in which ice machines are used or can be used to great advantage, in the next issue of ICE AND REFRIGERATION, and oblige, K. V. L.

ANSWER.—There are, indeed, many chemical industries in which artificial refrigeration is used already with very good success, and there are doubtless still more in which it will be introduced in the course of time. To mention them we should commence with butterine and oleomargarine works, manufactories of stearine, paraffine, aniline dyes, glue works, refining of mineral oils, potash works, asphalt and tar distilleries, nitroglycerine works, etc. In fact, all chemical operations which depend largely on differences in temperature, notably all those involving crystallization processes, can in most cases be greatly assisted by the use of artificial refrigeration. This is particularly true of substances which it is difficult to obtain in a pure state, and which do not pass into the solid state, except at very low temperature. To successfully purify such substances—and there are a great many of them—artificial refrigeration is the most available auxiliary, and very remarkable results have been obtained already in this direction. The most successful purification of glycerine in an instance of this kind. Chloroform is another still more remarkable example. This substance, although considered pure, was nevertheless of a very unstable character. Time, action of light, heat and other unavoidable conditions, caused its degeneration, until it was shown by Pictet that an absolutely pure article of chloroform could be obtained by crystallizing the same at a temperature of about --90°. This is a very low temperature, considering practical possibilities of the present day, but it accomplishes the object, and there are many more equally useful applications not yet thought of, or beyond the reach of practical refrigeration at present, which only wait for the production of machinery equal to the task, to become of industrial significance and importance.

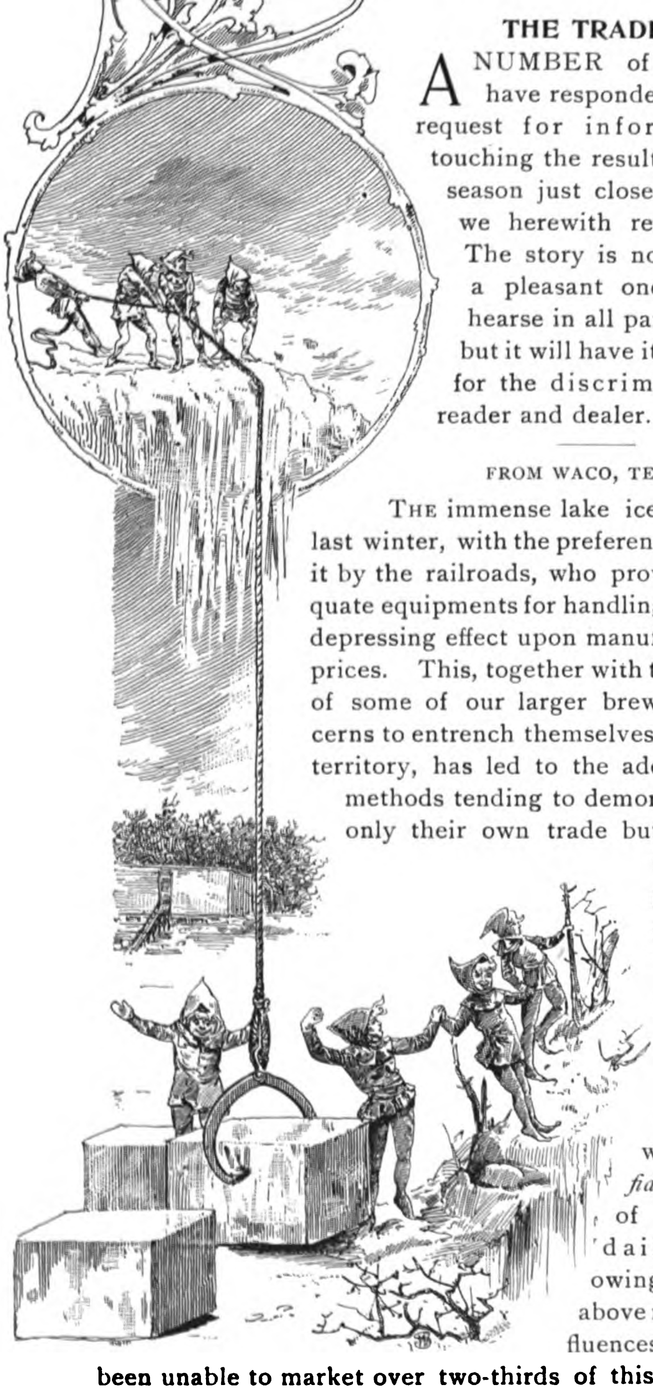
THE LIMIT OF REFRIGERATION.

To the Editor: Is it possible to reach the absolute zero of temperature by artificial refrigeration? CH. R.

ANSWER.—In his experiments made for obtaining very low temperatures, Pictet reached a temperature of —200° Celsius, and according to his opinion it would be impossible to reach absolute zero, as the radiation of cold is too vehement at such low temperatures, there being no bad conductors or insulators at these degrees; the cold passing through all of them as if they were good conductors of heat. For these reasons Mr. Pictet thinks that it will be impossible to reach temperatures below —255° Celsius. The absolute zero of temperature is placed at —273° Celsius, that is 18° below the temperature which Pictet considers it possible to reach. In subsequent experiments made by Prof. Dewar, the lowest temperature reached was —210° Celsius. This gentleman expects to soon be able to reach down as low as —240° Celsius, at which temperature hydrogen will liquefy, but he does not say whether or not he considers this the greatest cold possible to obtain. The difficulties suggested by Prof. Pictet are doubtless of the greatest moment, but nevertheless it must be admitted that they are so only by degrees, and it can hardly be maintained that they are absolutely insurmountable as a matter of course.

——Wm. Plankinton, on his return to Milwaukee, November 18, from New York announced that he has been in negotiation with eastern parties to lease to them the Plankinton packing house in the Menomonee valley.

THE ICE TRADE



THE TRADE.

A NUMBER of readers have responded to our request for information touching the results of the season just closed, which we herewith reproduce. The story is not always a pleasant one to rehearse in all particulars; but it will have its lessons for the discriminating reader and dealer.

FROM WACO, TEX.

THE immense lake ice crop of last winter, with the preference shown it by the railroads, who provide adequate equipments for handling it, had a depressing effect upon manufacturers' prices. This, together with the desire of some of our larger brewing concerns to entrench themselves in Texas territory, has led to the adoption of methods tending to demoralize not only their own trade but that of the legitimate ice manufacturer as well. We have 3 Hercules machines with a *bona fide* output of 100 tons daily, but, owing to the above named influences, have **been unable to market over two-thirds of this amount, and that only during the month of July. However much the railroads may desire to favor the lake ice trade, they will have to yield very soon, for the ice machine reigns jointly with "King Cotton" in the South. As to how long the brewers will maintain their present methods can be computed only by those who are more familiar with the profits in that commodity than the writer.**

Jas. E. Egan, Manager
Waco Ice and Refrigerating Co.

FROM SAN FRANCISCO, CAL.

We have to report some improvement in the cost, quality and quantity of ice manufactured and sold by this company this year as compared with last. The prices obtained, however, are somewhat lower and afford but little profit. Our capacity, running on half time in the winter season, is about 15,000 tons per annum and sales about 10,000 tons. We expect, however, that another season will see our machines working to their full capacity in the summer, when a reasonable profit can be made even at present low prices—as the last 5,000 tons can be made cheaper than the first. Good coal costs from $6.50 to $7 per ton, making ice cost more than twice as much as in the eastern states, on an average. Most of that sold in this state is natural ice, and there is perhaps from 100,000 to 150,000 tons sold of machine and natural ice, taking the state together, and, what is singular, the surplus of 5,000 tons we have controls the price for the whole state to a great extent, and particularly in this city. In other words, the combination that controls nearly all of the trade of the state fails to make any profit because of the competition caused by our efforts to sell those 5,000 tons. The past summer has been unusually cold, while our people have been economizing even in ice, on account of the money stringency. With normal conditions we would no doubt have kept our machines busy this season. *Consumers' Ice Co.*

FROM LINCOLN, NEB.

Regarding the ice trade of the past season, we have in all not had a very profitable season owing to the low price of ice. Trade has been almost exclusively retail, owing to the amount of natural ice stored south of us last winter. Prices here ranging as low as ten cents for heavy trade necessarily cut into our profits. Lack of confidence among the dealers seems to be the main trouble. The season, on the whole, has been favorable as to the weather, trade running well up to November 1. Hoping for a more satisfactory state of trade another season, we remain, *Lincoln Ice Co.*

FROM SPRINGFIELD, ILL.

We hardly know what to write as an account of the season's trade. It started very late because the early **summer months were so cool, and the dealers in natural ice, having their first full stock for several years, were inclined to rush matters by soliciting and offering lower prices, especially to butchers and hotels. But the warm weather settled prices and kept everybody busy attending to their own business, so that prices remained about $1 per ton below the previous season for large lots and $2 to families, being $4 per ton in box for butchers, $5 for large saloon trade, and 30c. per cwt. for families, which would pay a fair profit provided the sea-**

son were not cut short by cool weather. The machine ice has given general satisfaction; and while we have been compelled to sell several cars each week of river ice to supply our trade, customers always took it under protest and only because there was no manufactured ice to be had. As to "cause or remedy" for any unfavorable features of the trade, we would say that the worst feature of retail trade here is the reckless system of selling from the wagon by drivers, and the tendency to find excuses to cut prices and grant favors to special friends, and the intimacy between the driver and the restaurant and saloon or eating house keepers, whom he meets oftener than he does the man who hires him. We have a scheme which we think will remedy it, but don't dare tell it to your readers until we try it. We shall look forward to the answers to your letter with much interest, and would like to see some concert of action among retailers for profitable and pleasant exchange of views on such subjects, and would suggest a convention during winter months to talk it over at some warm resort.

W. B. Baker, President P. I. and C. S. Co.

FROM SPRINGFIELD, OHIO.

ON THE whole, we have had a very satisfactory summer on ice, and have nothing exceptional to report.

The Springfield Coal and Ice Co.

FROM WILMINGTON, N. C.

The ice business in this state this year has been very unsatisfactory all around. At the majority of places where ice is manufactured there has been competition with the natural result: cutting prices and necessarily unprofitable business. Where there was no competition the business was small, owing largely to the fact that everybody, rich and poor alike, have economized to the last degree, and bought but very little ice. Here at Wilmington where we have not had any natural ice before for five years, we had a new party in the field who thought there was "millions in it," and immediately cut the price 10 to 15 cents per hundred, with the usual result—the public got the benefit and the ice dealer the work. So far as we have observed the ice business has been very poor all over the state, owing, in our opinion, more largely to the fact that the people have not had the money to spend than any other cause. The summer was warm enough, but the volume of business this year was less than at any time within the last eight years. We believe that with the return of prosperity will come a very much larger demand. *Wm. E. Worth.*

FROM WHEELING, W. VA.

Local paper, November 11: The directors of the Wheeling (W. Va.) Ice and Storage Co. held their fall meeting at their office November 7, and heard the secretary's report of the year's business to November 1. Owing to sharp competition during the past summer, caused largely by the large crop of natural ice harvested last winter, together with the extreme low price of ice to large consumers, the latter are found to be about the only ones directly benefited by the season's work, having had exceedingly cheap ice all the year. The directors decided to pay no dividend this year. The company has been unable to sell more than two-thirds of the product during the summer. It stored a large quantity of manufactured ice to supply the trade during the fall and winter and is now busily engaged in making the annual repairs. With increased facilities for making ice and the new cold storage house it will be fully able to supply all the demands of the city and adjoining towns.

FROM HARRISBURG, PA.

The past season has proven most unfavorable to us, and we close the year at a loss. The immense quantity (unprecedented) of natural ice housed in this vicinity last winter caused such competition among those dealers that the price was cut as low as $1.50—in some instances $1—per ton, delivered in quantities of five tons; hotels and restaurants were furnished at 12½ cts. per cwt. We were obliged to meet the figures of natural ice people, with result above stated. I am convinced that manufactured ice is the coming ice for all commercial purposes, but that it cannot be produced and delivered in competition with natural ice in the hands of many competitors during a plentiful season of natural ice. *Crystal Ice Co.*

MISCELLANEOUS REPORTS.

SIOUX CITY *Journal*, November 12: "The ice men report that an unusually large amount of ice was left in their houses at the close of the present season, and that as a result the harvest will not be as heavy this winter as is usual. Some ice men are figuring already on some heavy contracts for ice to be shipped south."

The Haynes & DeWitt Ice Co., Augusta, Me., will ship this season about four-fifths of their ice, the largest amount in proportion to their stock on hand of any concern on the river.

Lawrence, Kan., dealers have about cleaned out their houses. The ice will probably last till the new crop comes, about the tenth of January next.

NATURAL ICE NOTES.

——E. N. Osgood is building an ice house at Surry, Me.

——Peter Jansen is building an ice house at Atwood, N. Y.

——Stephen Fogg is building an ice house at N. Sandwich, N. H.

——Morris & Gay will build another ice house at Boothbay, Maine.

——Nicholas Pine is rebuilding two of his ice houses at Dixon, Ill.

——Donahue Bros. are building a double ice house at Sioux Falls, S. D.

——M. C. Morrill is building an ice house at Dry Mills, near Portland, Me.

——Farrar & Lawrence will erect another ice house at Leominster, Mass.

——John H. Whitney is building an ice house at New Ipswich, N. H.

——The Gulf Railroad Co. will erect a fireproof ice house at Springfield, Mo.

——W. E. Bowker and H. E. Russell are each building an ice house, at Sumner, Me.

——Call & Means, ice dealers at Merrill, Wis., are building an ice house 55×120 feet.

——Anton Renk, Beardstown, Ill., is rebuilding one of his houses, 32×40, 22 ft. posts.

——Byam & Co. intend to build one or more ice houses at their pond at Canton, Mass.

——The Monmouth Ice Co. will shortly erect two new ice houses at Sea Bright, N. J.

——E. R. Russell is building another ice house on Bond street, in East Olean, N. Y.

——G. H. C. Bodeker is building a permanent ice elevator at his houses at Murphysboro, Ill.

——Lewis D. Bemis is building a large addition to his ice house on Lake Whittemore at Spencer, Mass.

——Philip Easterday will rebuild his ice house and resume retail business next summer at Tecumseh, Neb.

——The People's Ice Co., St. Paul, has taken out a permit to erect an ice house on Rice street, to cost $1,000.

——Mr. F. Forthman, Waynesboro, Pa., is erecting a larger and better ice house than the one burned in May last.

——The John Hilt Co.'s four ice houses at Clear lake, La Porte, Ind., will be entirely rebuilt for this year's crop.

——The Ann Arbor (Mich.) Brewing Co. have the foundations laid for two large ice houses which when completed will double its storage capacity of ice. The pond from which the ice will be cut has been enlarged and cleaned.

——E. C. Spooner is building an ice house at Sudbury.

——Geo. C. Robinson will build an ice house at Wakefield, R. I.

——The Knickerbocker Long Dock ice house, Catskill, N.Y., is being repaired.

——The Fresh Pond Ice Co. are building their new houses at Brookline, N. H.

——Wetzel & Liner are building a large ice house for Cleveland parties at Salem, Ohio.

——It is said the Knickerbocker Ice Co. will carry over about 400,000 tons of Hudson river ice.

——F. E. Reed is preparing to erect another ice house near his other buildings at Waterloo, Iowa.

——Joseph McMillan will erect an ice house, 40×140 feet in size, near the Reading works at Columbia, Pa.

——The Haverhill (Mass.) Ice Co. are rebuilding the houses recently blown down, and repairing the others.

——The Housatonic Ice Co. are building an ice house 170×55 near Island Brook pond at Bridgeport, Conn.

——The Wisconsin Lakes Ice Co., Milwaukee, has taken out a permit to build a warehouse in the city to cost $2,500.

——Rich & Todd, Carroll, Iowa, have completed their new building which will give them room for 2,000 tons of ice.

——I. C. Moulton, at Bolton Notch, near Westerly, R. I., will erect an ice house on the site of the one recently burned.

——The official board of the hospital at Carbondale, Pa., have decided to build an ice house on the grounds of the institution.

——The South Boston Ice Co. will erect a number of new buildings at Silver lake, Rockland, Mass., to increase storage capacity.

——Whiting & Son, of Warren, N. H., will put up at the depot an ice house of 600 tons capacity in connection with his dairy business.

——Mr. Wm. Wilson, formerly with the Hercules Iron Works, is now in the employ of the Sulzer-Vogt Machine Co., of Louisville, Ky.

——Welliver & Booher will build an ice house near the creek, and prepare to go into the ice business at Darlington, Ind., next summer.

——Cullen & Wolfe, ice dealers of Fort Dodge, Iowa, are erecting an ice house on the banks of the Des Moines river, the building when completed to be 150×100 feet.

——Mr. Wall is erecting an ice house at the creamery at Espyville, Pa. It is believed that more of the farmers of the neighborhood will engage in the dairy business next season.

——Samuel Ceaser, Dalton, Mass., is making preparations to build an ice house on his land, located some distance up the stream east of his present one. It will be larger in dimensions and built on a different plan.

——The foundation for two more large ice houses has been laid at the lake at Brookline, N. H. The warm weather through October made a large demand for the ice, and about all of the immense amount stored last winter has been used.

——The old Jamaica Pond Ice Co., of Boston, now merged in the Boston Ice Co., is at work at Sharon, Mass., preparing the plant there for the winter's harvest. Six houses, each 37×80, 31 ft. posts will be erected, to be ready by January 1, 1894.

——Postmaster Canton, of Cohoes, N. Y., has built two large new ice houses near Crescent and has made extensive improvements to his old ones. He has also placed a new engine in position and has otherwise improved his apparatus for storing ice.

——Mr. Thornton, ice dealer at Auburn, N. Y., is building an ice house at Fair Haven, near Oswego. This step is said to have been forced by the health authorities having condemned the ice cut in Oswasco and Cayuga lakes as impure, owing to sewerage emptying therein.

——Beck & Webster are building four ice houses on the Little Kankakee river, at South Bend, Ind. These houses will give them an increased capacity of about 6,000 tons, and they hope to put up enough ice the coming winter to make themselves independent of an outside supply.

——The work of the Seekonk Ice Co., preparatory to harvesting the winter's crop of ice has been commenced at the two houses at Riverside. The meadow land has been cleared of bushes and other obstructions, and November 15 the water gates were closed to fill the pond. The houses have been cleared out.

——The Silver Lake Ice Co. has been for some weeks shipping ice from the Silver Lake house at the rate of six to eight car loads per day. The runway for loading cars at Perry, N.Y., has been lengthened out, and it is said the company are preparing to cut and ship the coming season double the amount of any previous year.

——Pattison & Sweet, ice dealers, have just purchased a tract of land on the Dudley turnpike, 150 feet front, near Stevens' upper pond, Webster, Mass., and will erect a large ice storage house. Their house on Pleasant street will be enlarged. The firm will house 1,500 tons for next season's trade. They were obliged to purchase ice after September to supply the demand of the past season.

——A new ice firm, called the Wallum Pond Ice Co., with a large capital, has been formed at Providence, R. I., and has purchased a tract of land on the east side of the Springfield road in Olneyville, on which it is intended to erect a number of ice houses to hold 50,000 tons. This firm, of which Manager Smith, of the Mathewson Ice Co., is at the head, has just completed the purchase of Wallum pond, in Burrillville, and it is from this sheet of water that it will harvest its ice. The work of building the ice houses will be commenced at once.

——The Lincoln Ice Co. of Chicago, recently purchased of W. J. Finke and John H. Uhen, the Hoffman farm of sixty-three acres, on the shores of Brown's lake, Wis., the price paid for the same being $7,000. It is the company's intention to erect a number of large ice houses on the property, also a large boarding house for their employes, and Mr. Boyle may also erect a commodious residence for his own use. The St. Paul road will run a spur from their main track to the property. The company about the same time had a surveyor at Burlington, Wis., staking out the spur track from the ice houses on Norton's lake to Brown's lake. The ice houses and other buildings on Brown's lake were also staked out and work on the same will commence at an early day.

——The Great Falls Ice Co., of Washington, D. C., in addition to the money paid to the crews at the ice houses, spent about $12,000 the past season in improvements upon their plant at South Gardiner, Me., and, as a result, now have one of the best houses on the Kennebec. The old house has been repaired and repainted. The ice stack north of it has been torn down and a new and model building erected. The new house will hold about $16,000 tons of ice, making the total capacity of the plant over 35,000 tons. It has double walls, the outer one of the self-bracing, flaring type and the inner one an 8-inch sawdust packed wall. The new house is 160 feet square and is divided into eight rooms by six walls of the latter type. The building is designed to have the ice stacked to a height of thirty-two feet. The runs and elevators used will be those on the old house, connected by the galleries between the two buildings. No pains have been spared to make the plant perfect. Next summer the company will tear down its houses at the Ledges, in Pittston, and put up one of the same kind as the new ones at Gardiner.

OUR HONORS.

THE exhibit of H. S. Rich & Co. at the World's Fair, consisting of files of ICE AND REFRIGERATION and *The Western Brewer*, received the only award made for trade papers in these lines of industry, the diploma stating as specific basis of merit: "Editorial, artistic and typographical excellence." ICE AND REFRIGERATION has no competitor in the true sense of the term, nevertheless this recognition of the importance of the purpose and work of this journal is most gratifying to both the editor and the publishers, since it is an official statement that the work we are endeavoring to do has been, and will continue to be of substantial benefit to this and coming generations.

WORLD'S FAIR AWARDS.

THE Penberthy Injector Co., of Detroit, Mich., was awarded medal for merit on their "Penberthy Automatic Injector." This injector has been on the market about six and a half years, and nearly 75,000 have been placed on boilers in all parts of the world.

The Reliance Gauge Co., Cleveland, carried off the honors for its class, receiving all the awards on both safety water columns and floats, the awards being based on their actual performance on boilers in the power plant of the Exposition.

——In fulfillment of its contract Sioux City on November 24 transferred to the Cudahys their plant there free of all cost to them. The house has a capacity of 5,000 hogs a day and is valued at $1,300,000. The Cudahys had ceased operations pending a settlement of differences, and will now resume operations.

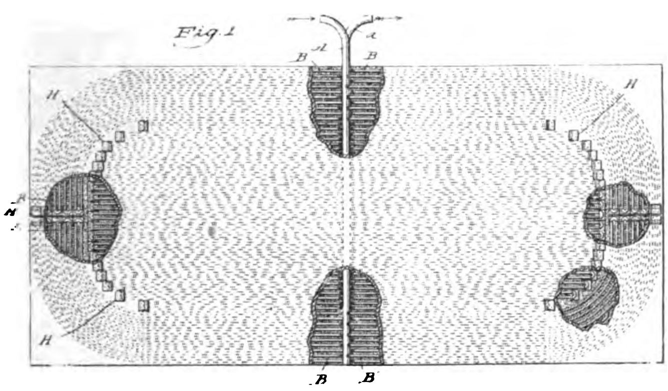
——The following brewers have recently purchased refrigerating machines from the Buffalo Refrigerating Machine Co.: Latrobe (Pa.) Brewing Co., 20 ton; Panonia Brewing Co., Middleburgh, Ohio, 20-ton; Piel Bros'. Brewery, Brooklyn, N. Y., 40-ton; Dotterweich Brewing Co., Olean, N. Y., 40-ton; Essex County Brewing Co., Newark, N. J., 35-ton; C. H. Hartman, Bridgeport, Conn, 40-ton; Lake View Brewing Co., Buffalo, N. Y., 65-ton.

A SKATING RINK.

THOS. L. Rankin, whose ice railway, or toboggan slide, in Midway Plaisance, during the past summer, was one of the great popular successes of the great Exposition, having on "Chicago day" carried the amazing number of over 19,000 people on its ellipse, November 14 took out a patent for an artificial ice skating rink, by which the construction of the rink is greatly simplified, and also modified, with a view to a more economical construction and maintenance, and to the free use of all or a part of the floor for general purposes, thus greatly increasing the practicability of the artificial ice rink as a means of popular amusement.

The patent specifications tell us that the object is to provide a rink in which the [expansion or brine circulating] piping will be arranged to make a frosted or icy surface in the form of a loop, or narrow track, at the outer edge of the main floor of the rink. Fig. 1 will disclose the idea, if the reader will note the manner of piping and the trend of the feint lines above. The piping is also arranged, as will be seen in Fig. 1, to frost the entire surface if desired. However, it is often desirable to have only the loop iced, using the center area for other purposes, such as for café tables, as a promenade, a summer garden, etc., which area will, of course, be delightfully cooled by the surrounding loop or iced surface.

Another object of this patent is to provide improved flooring for such rinks by incasing, or imbedding, the pipes in a composition of asphalt or other suitable cement and metallic filings or borings to make the floor a good conductor and bring the cold to the surface and



produce a coating of ice thereon when sprayed by water. Such a floor makes it possible to use the building for any other purpose than skating by simply thawing off the icy surface when the absence of the ice is desired. Or the center may be uniced, as said, and the loop iced and used for skating.

Fig. 2 presents the system of piping, etc., which need not be specially explained further than to say that Fig. 2 is a detail transverse sectional view showing the headers and freezing pipe connections; Fig. 3, enlarged sectional view of the flooring and pipe bends; Figs. 4 and 5, the metallic caps employed to protect the bends of the freezing pipes and permit expansion thereof. The patentee says: "As large ice plants are now becoming common in all cities, this style of rink will be very practical to use in connection therewith, as in the winter time the entire ice floor may be used as a rink without lessening the desired output of the plant; and in the summer time we can make a combination of a garden and skating rink with ice surface only around the sides, which will not require enough refrigerating power to materially interfere with the ice making capacity of the plant, thus utilizing refrigerating plants already established for skating in the winter on a large scale, and in the summer sufficient to get a cool room for a

Fig. 2.

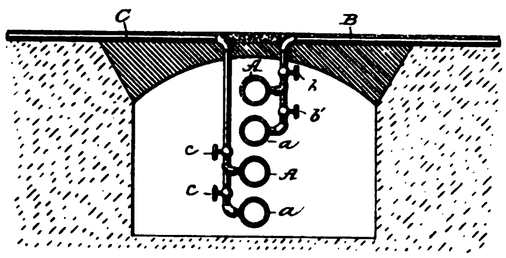
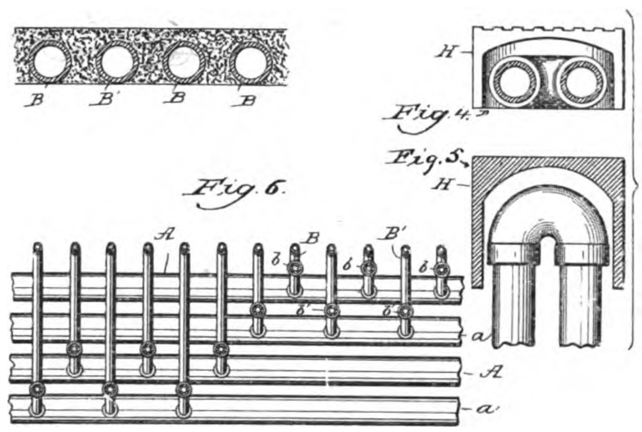


Fig. 3.



pleasure garden and rink. The flooring is such that the building can be employed for business or other purposes, like ordinary buildings, when it is not desired to use the place as an ice rink or refrigerator warehouse, and this peculiar feature of the ice flooring I consider a valuable feature of the invention."

OUR NEXT VOLUME.

THE present number closes the fifth volume of ICE AND REFRIGERATION—a volume, it is believed, that will compare favorably with the four preceding it. With the new year, January issue, the editor expects to present the reader with several papers of exceptional value on entirely new topics by recent additions to our corps of special contributors, all of which will be illustrated. We can assure our readers and patrons and the trade in general that no effort or expense will be spared by the publishers to maintain the high standard of literary contents and mechanical workmanship which this journal has held in the past.

BREWERY REFRIGERATION.

IT is with pleasure that we call attention to the beginning in this issue of a series of articles on "Artifical Refrigeration in Breweries," by Auguste J. Rossi, B.S., C.E. Mr. Rossi has written so many able papers for ICE AND REFRIGERATION that we are sure this new series will meet with a hearty reception by all readers, and be especially welcomed by the great industry to which it is especially addressed. It will treat the subject exhaustively, and will run through several issues.

——The annual meeting of the Consolidated Ice Co., Shreveport, La., was held November 14, and the following officers were elected to serve for the ensuing year: C. W. Dawley, president; G. L. Blackford, vice-president; L. R. Logan, secretary.

THE money market having become easy again and somewhat of the panicky feeling disappeared, building operations have resumed, and in the main the ice and refrigerating machine men are beginning to feel a return of business—not "rushing," but a good, healthy inquiry. The orders placed now are most desirable, because they are least of all speculative. It is not likely that the trade will feel any boom until congress has adopted 'a fiscal system of some sort which will guarantee permanency, and put an end to present uncertainty in reference to what is to be. Our record indicates that the future promises well.

ILLINOIS.

Aurora.—The Fox River Butter Co. will erect a two and one-half story cold storage plant upon the "Q" property on North Broadway north of the Spring street viaduct. It will be a frame structure and will cost about $2,500.

Chicago.—The Consumers' Ice Co. have begun work on the cold storage addition to the plant, at Thirty-fifth and Butler streets. It will be forty feet high and will extend over an area of 103×151 feet. It will be constructed of brick and cost $30,000.

Galesburg.—A movement is on foot by several influential citizens of Galesburg looking to the establishing of an ice factory in this city. The first step is the organizing of a company with a capital stock of $30,000.

INDIANA.

Frankfort.—A company is being organized here for the purpose of manufacturing ice by D. P. Barner, Wm. G. Morris, Geo. L. Thompson, H. C. Sheridan, A. A. Laird and Jas. H. Chamberlain. The company propose to purchase a machine with a capacity of fifteen tons per day, and will aim to supply the local market.

Vincennes.—J. L. Ebner has closed a contract with Westerlin & Campbell, Chicago, for a 75-ton Consolidated ice making machine and one of their improved condensers (patent applied for) to be erected in his ice factory.

IOWA.

Des Moines.—E. H. Lyman has decided to erect a four-story brick block, to cost $25,000, on Court avenue, to replace the two-story block which was partially destroyed by fire a few weeks ago. It will not be a remodeling of the old building, which was occupied before the fire by the Layman Cold Storage Co., but the erection of a new building. The old walls will be removed and new foundations laid. It is probable that work upon the tearing away and construction of the walls will commence this fall and the building be erected next spring. It will be a modern structure in every respect. The plans for the structure, which will be of stone and brick, are now being prepared by a well known architect.

KENTUCKY.

Lexington.—The Consumers' Ice Co. has decided to erect a factory, and will do so as soon as a site can be obtained.

Shelbyville.—The Consumers' Ice Co. will build an ice factory.

LOUISIANA.

Shreveport.—The Consolidated Ice Co. have decided to enlarge both the ice works and bottling plant. Between $5,000 and $7,000 will be expended for that purpose.

MEXICO.

Tampico.—A large cold storage and refrigerator plant is being erected by New York capitalists. It is stated that 400 tons of ice machinery have been ordered for the plant.

Mexico.—Jas. Meehan, of Cincinnati, will go to the City of Mexico, says the Cincinnati *Times-Star*, "to examine into the feasibility of utilizing the power from a great waterfall near the City of Mexico for the manufacture of artificial ice. Fuel at that place is $17 a ton, and Mr. Meehan says he can manufacture ice at seventy-five cents a ton, and it being summer there the year round and ice in demand the twelve months in the year, there is, Mr. Meehan says, a wonderful field for the capitalist."

MARYLAND.

Baltimore.—Frederick W. Davidson, Charles G. Hill, George F. Littlejohn, George W. Orem, Jr., and Charles W. Schwarzkopf have incorporated the Economy Ice Co. to manufacture ice; capital, $100,000.

MASSACHUSETTS.

Mattapan.—The Dorchester Hygeia Ice Co. have completed their arrangements for an ice plant to be located here, and have commenced to clear the land preparatory to the erection of a suitable building.

Spencer.—Aaron Hammond has purchased of E. E. Stone & Co. a piece of land in about the same location as his last refrigerator stood. It is 32×52 feet and he intends to build the refrigerator to cover all the land but one story high. The ice box will be built on a little different plan from the last one.

Worcester.—The White, Pevey & Dexter Co. have taken out a permit to build a one-story brick addition, 64×133 for cold storage, on Putnam lane.

NORTH CAROLINA.

Charlotte.—Wm. E. Worth, of Wilmington, advertises for proposals for the building of a factory here.

PENNSYLVANIA.

Chester.—The Consumers' Ice Co. will double the capacity of their ice making plant.

Coatesville.—Shallcross & Son are enlarging their ice factory.

Nanticoke.—A stock company has just been organized to build an ice factory.

South Bethlehem.—The Lehigh Valley Cold Storage and Ice Manufacturing Co., with capital stock of $135,000, has been organized, the officers being Adam Brinker, president; J. B. Meixell, secretary and treasurer, and Henry Kreiss, M. C. J. Stupp, H. Y. Kauffman, E. W. Landis, M. Muhlenberg, all of Reading, and S. S. Wagner and A. L. Wickert, of South Bethlehem, members of the board of directors. The company has purchased two lots at Fourth and Birch streets, upon which two buildings will be erected for storage purposes. The structures will be of brick, the main building to be four stories, and the other two stories high. The latter will contain engine room and two artesian wells for supplying water from which to manufacture ice. The contract has been awarded to Kreiss & Stupp, of Reading, Pa., who have sublet it to Josiah Wilt. A side track from the railroad will be run into the building. The estimated cost is $150,000. All the space within the building will be taken by S. S. Long & Co., butter and egg dealers, New York city, who will have the butter and eggs they purchase throughout the west shipped there, whence they will be supplied to customers direct. The capacity of the building will be 120 car loads or 60,000 crates of eggs. The ice making plant will have a capacity of forty tons every twenty-four hours. The machinery will consist of two 50-ton Consolidated machines, supplied by John Featherstone's Sons, Chicago, through Kreiss & Stupp, eastern agents.

SOUTH CAROLINA.

Charleston.—The Cold Storage and Manufacturing Co. has been chartered for the purpose of conducting a cold storage business. The incorporators are William Mappus, C. F. Myer, A. S. Grant, F. L. Hackemann and G. W. Myer.

SOUTH DAKOTA.

Mitchell.—Fred Widmann is making preparations to build a cold storage plant and ice house at the Milwaukee railroad tracks.

TEXAS.

Cleburne.—The Cleburne Ice and Cold Storage Co. will rebuild its ice factory reported as burned.

Marshall.—The Arkansas and Texas Consolidated Ice Co. will put in a new 15-ton machine.

Pittsburg.—The Pittsburg Bottling Works will put in an ice plant for next season. J. L. Newsom, manager.

West Denison.—A 50-ton ice plant will be erected in West Denison in the near future. This will be an addition to the already large ice business done in Denison.

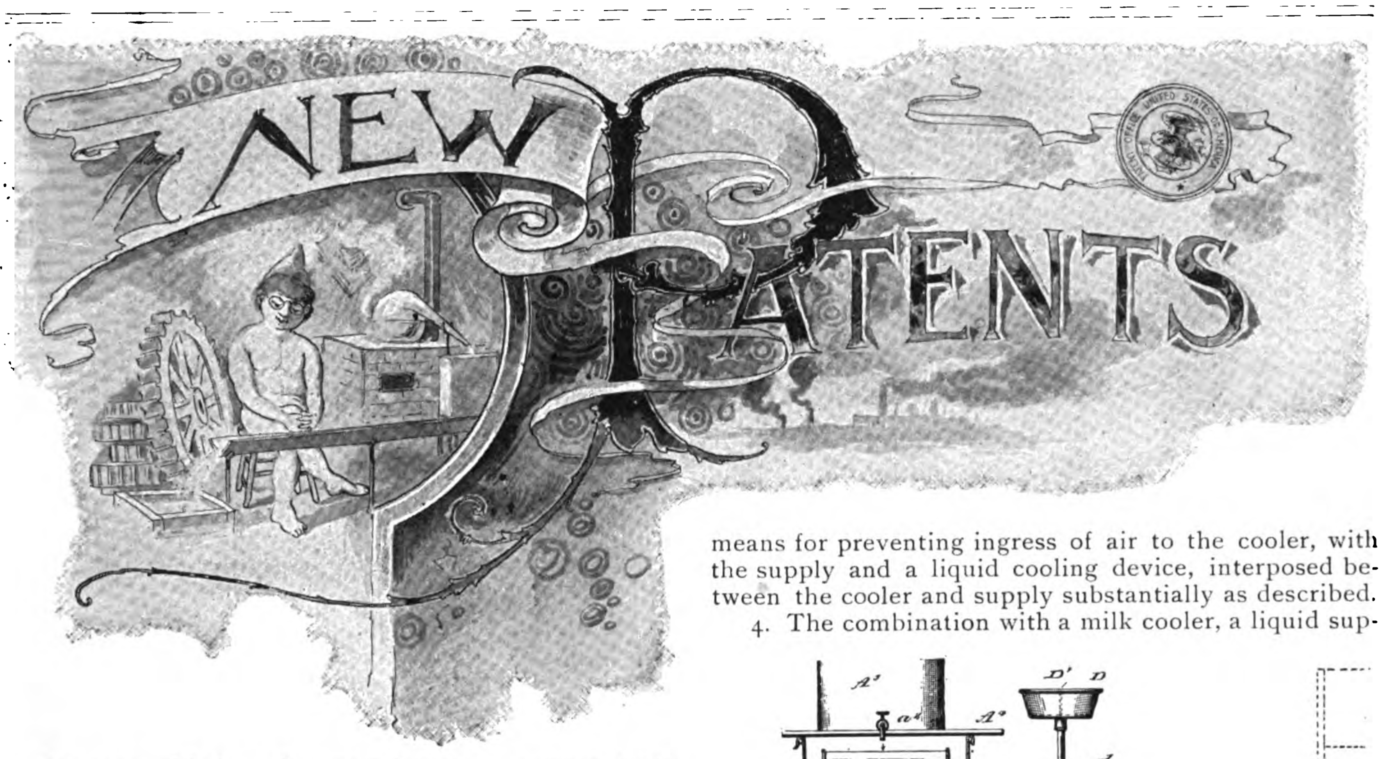
WEST VIRGINIA.

Wheeling.—On November 10 the butchers of the city held a meeting to consider plans for the erection of a new ice plant. The meeting was devoted mainly to the discussion of plans to raise the necessary money to build and equip the plant. During the week following the movement was joined by some other consumers, and the stock subscription paper now shows $75,000 subscribed. The main pillars of the movement kept out of it until the proposition seemed assured of success. The parties at the head of the new enterprise are now in correspondence with ice machine manufacturers, two bids having already been received, and it is said that work will soon be started on the plant.

WISCONSIN.

Bayfield.—William Dittus has a force of men at work excavating for the basement of a large cold storage house. The basement will be sandstone and the building will be two stories above the basement.

——The Standard Ice Co., of Hamilton, Ohio, of which S. A. Campbell was recently receiver, will resume business under the old name of the Fisher Ice Tool Co. The receiver's report of his sale of the property to Peter Schwab, subject to a lien of the Eaton Building Association, has been confirmed.

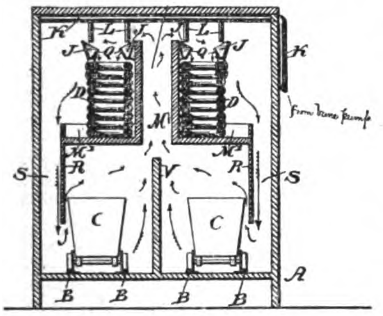


We append below the most important new patents relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for Ice and Refrigeration.

ICE MACHINE.

No. 504,986, John Kurtz, Philadelphia, Pa. Filed September 15, 1892. Serial No. 445,977. Patented September 17, 1893. (No model.)

Claim.—1. In an ice manufacturing machine, a casing, a partition rising from the floor of said casing, drip troughs supported by said casing, and ammonia coils supported in said casing, said drip troughs having depending partitions forming with the sides of the casing air passages, and also having between them a flue leading from the spaces on the sides of the floor partition, said parts being combined, substantially as described.



2. In an ice manufacturing machine,' a casing with a floor having tracks thereon, tanks movable on said tracks, a partition between said tanks, ammonia coils above said tanks, brine drip troughs above and below said coils communicating with a brine tank, and partitions depending from said lower brine troughs forming with the sides of the casing cold air flues, said parts being combined, substantially as described.

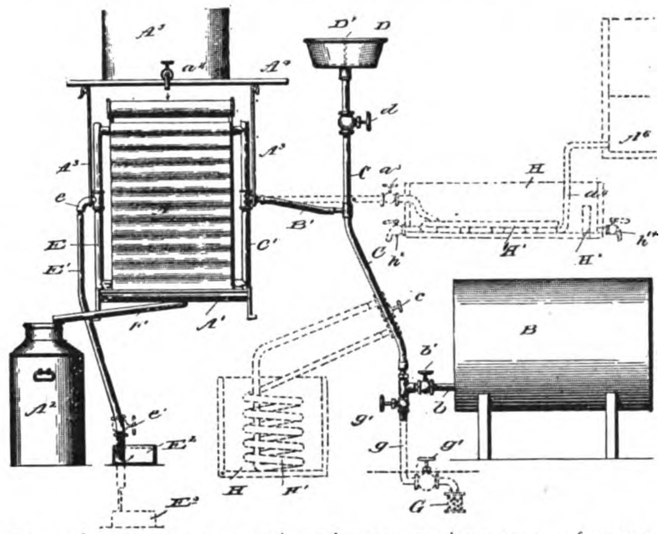
3. In an ice manufacturing machine, a casing, tanks movable on tracks on the floor of said casing, a partition rising from the floor between said tanks, ammonia coil pipes communicating with an ammonia supply tank, brine troughs supported above said coils, other brine troughs below said coils forming a vapor flue between the same, and having depending partitions forming with the sides of the casing, cold air flues, and pipes communicating with said brine troughs and a brine supply tank, said parts being combined, substantially as described.

MILK COOLING APPARATUS.

No. 507,730. Samuel M. Heulings, Haddonfield, N. J., assignor to the Star Milk Cooler Company, same place. Filed November 4, 1892. Serial No. 450,966. Patented October 31, 1893. (No model.)

Claim.—1. The combination with the milk cooler, a liquid supply and connections between the same, of means for preventing ingress of air to the cooler, with the supply and a liquid cooling device, interposed between the cooler and supply substantially as described.

4. The combination with a milk cooler, a liquid sup-

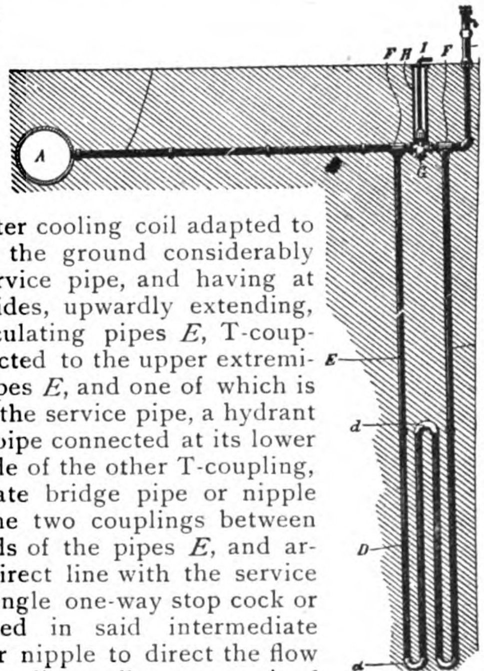


ply and siphon connections between the same, of means for preventing ingress of air to the cooler and an interposed liquid cooling device with means for throwing it into or out of operative connection, as set forth.

WATER COOLER.

No. 506,529. Abner J. McGehee, Jackson, Tenn. Filed February 18, 1893. Serial No. 462,844. Patented October 10, 1893. (No model.)

Claim.—In a water cooling apparatus, the combination with the approximately horizontal service pipe; of a water cooling coil adapted to be placed in the ground considerably below the service pipe, and having at opposite sides, upwardly extending, valveless circulating pipes E, T-couplings F connected to the upper extremities of the pipes E, and one of which is coupled on to the service pipe, a hydrant or discharge pipe connected at its lower end to one side of the other T-coupling, an intermediate bridge pipe or nipple connecting the two couplings between the upper ends of the pipes E, and arranged in a direct line with the service pipe, and a single one-way stop cock or valve arranged in said intermediate bridge pipe or nipple to direct the flow through the cooling coil or to permit of a free passage for the water skirting the upper ends of the pipes E, substantially as set forth.



TRADE NOTES.

——The Tewes ice house at Hammond, Ind., was burned November 15; loss, $2,000.

——Heller & Son, of Sioux City, contemplate erecting a meat cooler at Mankato, Minn.

——The Thurston Cold Storage and Warehouse Co., St. Paul, Minn., has increased capital stock to $170,000.

——The Rochester (N. Y.) Candy Co. has purchased a 5-ton refrigerating machine of the Buffalo Refrigerating Machine Co.

——The annual meeting of the Crystal Ice and Cold Storage Co. was held November 14. The reports of the officers were encouraging. The plant was late in starting; it was new business to those engaged in it, and the capital stock subscribed was not quite sufficient, of the $85,000 stock but $64,000 having been taken, which crippled the company somewhat, in spite of which a little money was made and the officers expect to make a good dividend next year. The board of directors elected M. J. Eagal, president; O. C. Woods, vice-president; S. W. Pierce, secretary, and C. W. Decker, treasurer.

——The Minnesota Dairy Commission recently seized $6,000 worth of oleomargarine of the Armour company because it was not colored pink, according to the Minnesota statutes. The packing company applied to the United States Circuit court to grant an injunction preventing the commissioner from interfering with its sale of oleomargarine in that state. Attorneys for the company argued that the Minnesota law was a violation of both the constitution of the United States and the interstate commerce act. Judge Nelson issued an order temporarily restraining Commissioner Anderson from seizing or taking possession of any oleo the Armour company has now in the state or may hereafter ship in.

WANTED AND FOR SALE ADVERTISEMENTS.

[The charge for advertisements in this column is $2 each insertion for seventy words or less, and twenty-five cents for each additional fourteen words. No advertisements will be inserted unless accompanied by the necessary cash. Parties answering these advertisements must write to the addresses given, as the Publishers decline to furnish any information concerning them.]

For Sale.

Good second-hand ice machine, in perfect running order. Address "P. K.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Change of System.

We desire to change our factory from the "plate" to the "can" system, and solicit correspondence. The plant is a 10-ton compression engine. Address ORANGE ICE, LIGHT AND WATER WORKS CO., Orange, Tex.

Second-Hand Machine Wanted.

Wanted—a second-hand ice or refrigerating machine, from 5 to 10 tons capacity. Either compression or absorption machine will answer. Address, stating price, condition, etc., J. KING, care of Merchants' Exchange, Cincinnati, Ohio.

Wanted—Competent Engineer.

A well qualified and experienced engineer who fully understands the Boyle compression machine, to take charge of our several plants, will do well to correspond with us at once, stating salary and naming first-class references. Married man preferred. STANDARD ICE CO., Atlanta, Ga.

Position Wanted as Engineer.

A sober young man would like a position as engineer in an ice or cold storage factory. Twelve years' experience in running plate machines. Can come well recommended. Compression machines preferred. Address "H. R. H.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Situation Wanted.

Situation as chief engineer or superintendent of ice factory or cold storage. Have been engaged twelve years in making, repairing and running ice machines, and am fully competent to keep any plant in perfect order and working at highest point of efficiency and economy. Best references. Address "ENGINEER," P. O. Box 236, Richmond, Va.

Position as Erecting Engineer.

Wanted—position as erecting engineer or engineer in charge of machine. Have had thirteen years' experience with Boyle machine. Can give good reference, having been with Birmingham Ice Factory Co. for eleven years, as engineer and superintendent. Address J. P. WALKER, 2209 Avenue E, Birmingham, Ala.

Position Wanted as Engineer and Machinist.

A first-class engineer and machinist, capable of overhauling and reconstructing any ice or refrigerating plant, and who has been employed as erecting engineer for many years by one of the best known ice machine manufacturing companies in the country, wishes situation. Address "A. M.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Position Wanted.

Would engage with first-class party as superintendent or manager of ice factory, cold storage, etc. For fifteen years in charge as chief engineer or superintendent of building, erecting or running compression machines of standard type; at present in charge of one of the largest plants in the South; able to handle men; making of clear ice a specialty. Address "PALEMA," care ICE AND REFRIGERATION, 206 Broadway, New York.

New and Complete 15-Ton Ice Making Machine for Sale.

Corliss engine, 16x26 inch. Two single-acting ammonia gas compressors, 10x22 inch, same general style and construction as Boyle or Consolidated machine. 80-horse power boiler, steel freezing tank. 300 ice cans, No. 16 galvanized iron, 200 pound. Atmospheric ammonia condenser, containing 3,000 pipes. The whole machine complete, new and first-class, delivered on cars at Chicago, $12,500.00. Engine and compressors weigh 30,000 pounds, and will sell separate for $3,500.00. Can furnish any size machine wanted. Address E. A. DICKSON, 35 E. Indiana st., Chicago, Ill.

For Sale.

One Kline and Winkler machine rated at 20 tons refrigerating capacity, with improved Green engine; the compressor double-acting (horizontal). One De La Vergne machine rated at 32 tons refrigerating capacity; this machine is of the latest approved pattern, double-acting compressors (vertical) with Corliss engine (horizontal). One Consolidated refrigerating machine rated at 35 tons capacity; the engine on this machine is of Corliss pattern; the compressors are single-acting. One Arctic machine, with slide valve engine, rated at 25 tons refrigerating capacity. One Naylor machine, with Corliss engine, machine is rated at 50-ton refrigerating capacity, compressor double-acting, compressors and engine horizontal. One Buffalo machine rated at 6 tons; refrigerating machine, slide valve engine, compressors double-acting. One Linde machine rated at 25 tons refrigerating capacity; slide valve engine, compressor double-acting. One Linde machine rated at 25 tons refrigerating capacity; Corliss engine, compressor double-acting. One Case machine rated at 10 tons refrigerating capacity; slide valve engine. One Frick machine rated at 25 tons refrigerating capacity; slide valve engine. One 70-ton Arctic refrigerating machine, with Corliss engine; this machine is of the most approved pattern. VOSS & EVANS, 403, 405 and 407 E. 47th st., New York.

Sale of Nashville Ice Factory.

By virtue of resolutions unanimously adopted by the stockholders and Directors of the Nashville Ice Factory, said company has decided to go into voluntary liquidation, and the entire property of the company hereinafter described, together with its good will, will be offered for sale to the highest bidder, on the premises, in Nashville, on the 13th day of December, 1893. Said property will be sold for cash, subject to the encumbrances thereon, hereinafter mentioned, and will be offered for sale in two parcels, and afterwards as a whole, the biddings realizing the largest amount for the company to be accepted. The property to be sold consists of 135 feet of ground, located on the southeast corner of Walnut and Union streets, fronting 135 feet on the east side of Walnut street, running back between parallel lines along the south side of Union street, 161 feet to an alley. Excepting 10 feet along the Union street front, this property is covered by a brick, gravel roof building, and is used as the plant of the Nashville Ice Factory. The machinery therein consists of three Compression Ice Machines, built by David Boyle, complete in every particular; four large boilers, 60 x 16, two small pump boilers, and all pumps, tanks, cans, piping, etc., necessary to make a complete ice factory, and which is now in active operation. The ice machines are ten, fifteen and thirty tons daily capacity, respectively. The property above described is mortgaged to secure an issue of $25,000 first mortgage bonds, of which $21,000 are now outstanding, the remaining $4,000 being hypothecated to secure a loan of $3,240 of the company. Said property will be sold subject to this encumbrance. The second parcel of property to be sold consists of fifty feet of ground, fronting on Walnut street, adjoining the above described property, and covered by brick, gravel roof building, used as stables, wagon rooms, etc. Also 22 head of mules, 11 2-horse wagons, 1 1-horse ice wagon, 2 coal wagons and 1 coal cart, together with all harness, ice wagon tools, etc., complete, for handling ice. Also office furniture, consisting of safe, cash register, typewriter, desks, etc., all of which is now situated on the above described premises, and subject to inspection of all parties desiring to purchase same. The property last above described will be sold, subject to a deed of trust executed on the 25th day of October, 1893, for the purpose of securing the sum of $5,000 due by the company. Said deed of trust is registered in the Register's Office of Davidson County, in book ——, page ——, to which reference is made. Said property will be sold, subject to said encumbrances. The Nashville Ice Factory has a well established business, and a good list of customers; and its works will be kept in running order, and its business intact, until said day of sale, ready to turn over to the purchaser. Perfect title to all the property herein above described will be made to the purchaser, subject to the encumbrances above named. All communications in reference to said property, or information desired in reference thereto, should be addressed to the NASHVILLE ICE FACTORY, care of E. B. Criddle, Secretary, Nashville, Tenn. By order of the Board of Directors. W. A. ATCHISON, S. L. DEMOVILLE, R. H. GORDON, Committee.

ICE AND REFRIGERATION ILLUSTRATED

Vol. 6
Nos. 1 to 6

Jan. to June
1894

H. S. RICH & CO.
PUBLISHERS
CHICAGO & NEW YORK

Willing. Des.

ICE AND REFRIGERATION
CHICAGO-NEW YORK

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ICE AND REFRIGERATION
ILLVSTRATED

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

VOL. VI. NO. 1. CHICAGO : NEW YORK : JANUARY : 1894. $2.00 PER ANNUM.

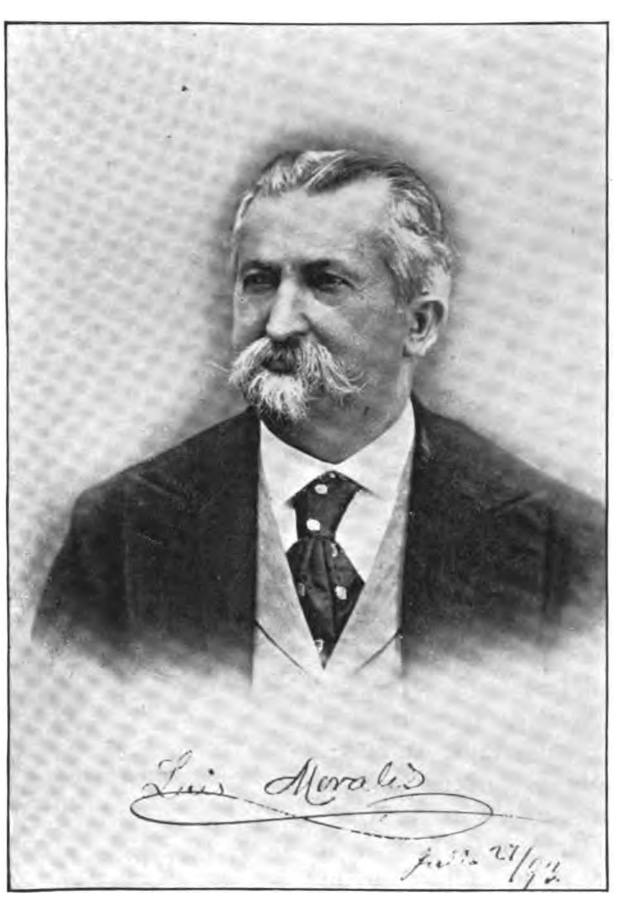
THE MACHINE'S FATE.

THE *News* at Bangor, Me., is responsible for this startling piece of information:

Reports from the South state that the past season has caused a complete collapse in the plans of the artificial ice makers. They had been stimulated by high prices for several years, and hoping the "pudding" would last forever, many firms got in debt for new machinery, believing they could pay up in a few years. Then came the low prices of 1893, and now ice machine stock and Keeley motor stock are selling very low. Of course a season of no ice on the Hudson and a poor crop on the Kennebec and Penobscot would again get up a boom for artificial ice; but with average crops at an average expense for the next two or three years, the artificial ice men will throw up the sponge, and Maine ice men will again sell all the ice they can put up.

This reads as "natural as life"; but it is not true, just the same. On the contrary, the ice machine in the North, as well as in the South, was last season able to compete with natural ice wherever the two came in contact. This fact is really the most conspicuous feature of a year that owing to business depression was only moderately satisfactory, while generally profitable in a degree. It is not usual, of course, for managers of private businesses to announce their profits or losses; but so far as they have been made public, and have come to our notice, it can be said that the "machine" ice companies have earned dividends quite as good as those earned by the natural ice companies. It has been the general depression of business which has affected the ice trade, and that depression has been shared by all dealers alike.

It was expected, aside from any business collapse, that the season of 1893 would be especially hard on the machine ice, because the abundance of natural ice everywhere had made it possible to put the machine to the maximum of test in competition with nature's product; yet it is apparent to all observers that the machine has come out of that test in a way that should forever set at rest the question of the machine's ability to hold its own at any time. It is, therefore, only right that the ice cutter as well as the ice maker should know and appreciate the truth, and understand just what each is capable of doing, and it is a sorry service which our secular friend of the *News* is trying to do, that of deceiving its readers as to the character of the competition they, as dealers in natural ice only, must continue to meet in the business of cutting and handling ice; for they are bound sooner or later to learn the truth, at a time when, perhaps, the lesson may be unnecessarily costly.



LUIS MORALES,
Ice and Chocolate Manufacturer, Merida, Yucatan.

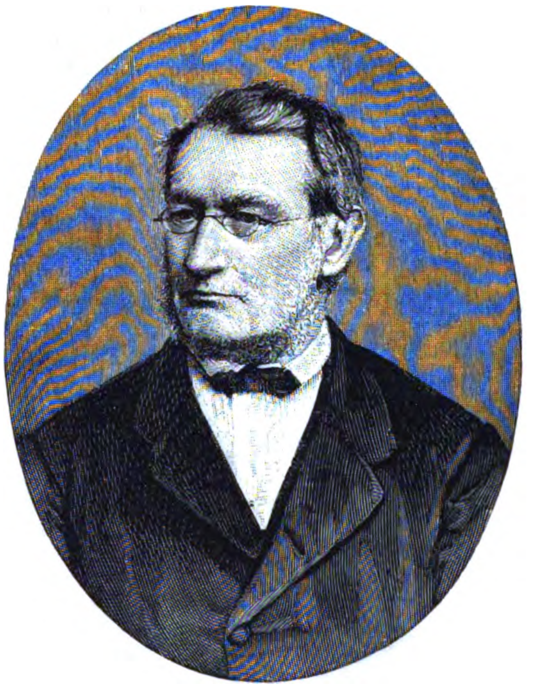
There is not, as ICE AND REFRIGERATION has repeatedly said, any but an imaginary conflict between the dealers in natural and machine ice. The product each handles is *ice*, and each dealer is compelled to lay in his supplies—his stock, which is always *manufactured*, either by nature or by machine. Now, if nature can so make ice that a man can cut it and house it and keep it from winter until summer at a less cost than he can make it by steam, then no one will be fool enough to make ice by any other process; but if these conditions are reversed, no one ought to be fool enough to depend on nature's doing for him what he can do much better for himself.

The whole question is one of the *first cost of ice*—the stock in trade of the dealer. That matter of economy each dealer must determine for himself.

ROBERT MAYER.

THE accompanying portrait of the late Robert Mayer, the originator of the conception of the indestructibility of force, and the first man to give a correct definition and an approximately correct numerical determination of the mechanical equivalent of heat, is taken from an excellent photograph made in 1868. It shows the celebrated scientist at the age of fifty-four. We have frequently had occasion to allude to the works and discoveries of this successful but unfortunate savant, but a short recapitulation of the most important incidents of his life may find a place in connection with the portrait.

Julius Robert Mayer was born in Heilbronn, November 25, 1814, and received a medical education. For a time he acted as county physician, and afterward as city physician to the city of Heilbronn. In 1840 he made a voyage on a Dutch freighter to Java, and it was the accident of bleeding a feverish patient in that country and observing that the venous blood in the tropics was of a much brighter red than in the colder latitudes, that led him to those investigations of natural forces, the chief results of which were published in the essays enumerated below.



THE LATE ROBERT MAYER.

In 1842 he published his first paper on the "Forces of Inorganic Nature." It was a short but comprehensive essay, and as such was published in "Liebigs Annalen" to secure the public recognition of his claims. In 1845 an able essay of 192 pages on "Organic Motion and Nutrition" was published by Mayer. This was followed by a third paper on "Celestial Dynamics" (1848), and a fourth one on the "Mechanical Equivalent of Heat (1851).

It is a fact, upon which we will not enlarge at present, that Mayer's discoveries did not find proper recognition among scientific men for some years afterward, and especially not among his own countrymen. It was left to the French academy in 1845 to determine in his favor the claim of priority of discovery between Mayer and Joule. But even this did not suffice to spare Mayer the attacks of his contemporaries, some disputing the priority of his discoveries, and others their value. Being thus treated, Mayer's constitution yielded to wounded pride and unsatisfied ambition, and an uncontrollable excitement gave rise to an inflammation of the brain, and at times he found it advisable to confine himself to an asylum. In quiet periods he wrote several able essays, but on the whole, the last twenty-eight years of his life were spoiled. He had the satisfaction, however, of seeing his labors recognized as having achieved an immense progress in natural science, and he became the recipient of many diplomas and decorations from princes, learned societies, etc., too numerous to mention here. He had also been married, and it is consoling to know that his children were an honor to him and gave him great satisfactton. He died on the 20th of March, 1878, of an affection of the lungs.

TRANSPORTATION OF LIQUID AIR.

IN connection with the forthcoming lectures at the Royal Institution on "Air, Gaseous and Liquid," it may be mentioned that Prof. Dewar has successfully conveyed a considerable quantity of liquid air from London to Cambridge. The liquid air was carried in one of the double glass, vacuum jacketed flasks, the space between the inner and outer flask containing nothing but extremely attenuated mercurial vapor, together with a little liquid mercury. On pouring liquid air into the inner flask its outer surface is rapidly covered with a mercurial film of extreme thinness, forming a reflecting surface highly impervious to radiant heat. As soon as this is formed the whole apparatus is packed in solid carbonic acid, which at once freezes the liquid mercury, arrests the deposit upon the mirror, reduces the mercurial vapor to an infinitesimal quantity, forms an almost perfect vacuum, and supplies an envelope 80° below zero. Thus protected, the liquid air reached Cambridge. The protective power of the high vacuum and the mercurial mirror will be better appreciated if it be borne in mind that the difference of temperature between liquid air and solid carbonic acid is the same as between ice and boiling water.

"WE notice in the number of ICE AND REFRIGETATION before us," says a valued correspondent, "an article called 'Cold Water Refrigeration,' in which the milkman asks why water at a temperature of 50°, passing through pipes surrounding a room, will reduce the temperature of the room to 48°. This is explained by evaporation, and if your correspondent will in the summer time, place a thermometer in a running stream of water at a temperature of 85°, and expose that thermometer to the air at a temperature of 75°, he will find the mercury will drop in a very few minutes to 68° to 70°."

NEW BOOKS.

REMINGTON MACHINE Co. Catalogue of the Remington Refrigerating Machinery. Wilmington, Del. 1893. 16mo; pp. 56. Free on application.

This is a neatly printed, cloth bound pamphlet prepared for those interested in ice making and refrigeration, and gives a general description of the methods employed and the machinery manufactured by the above named company. The text is amply illustrated by cuts of refrigerating machines and special parts of engines, fillings, etc., drawings of model ice factories on can or plate systems, and of small refrigerating plants, etc. An appendix contains some useful information for ice makers and cold storage managers, and testimonials of users of Remington machinery.

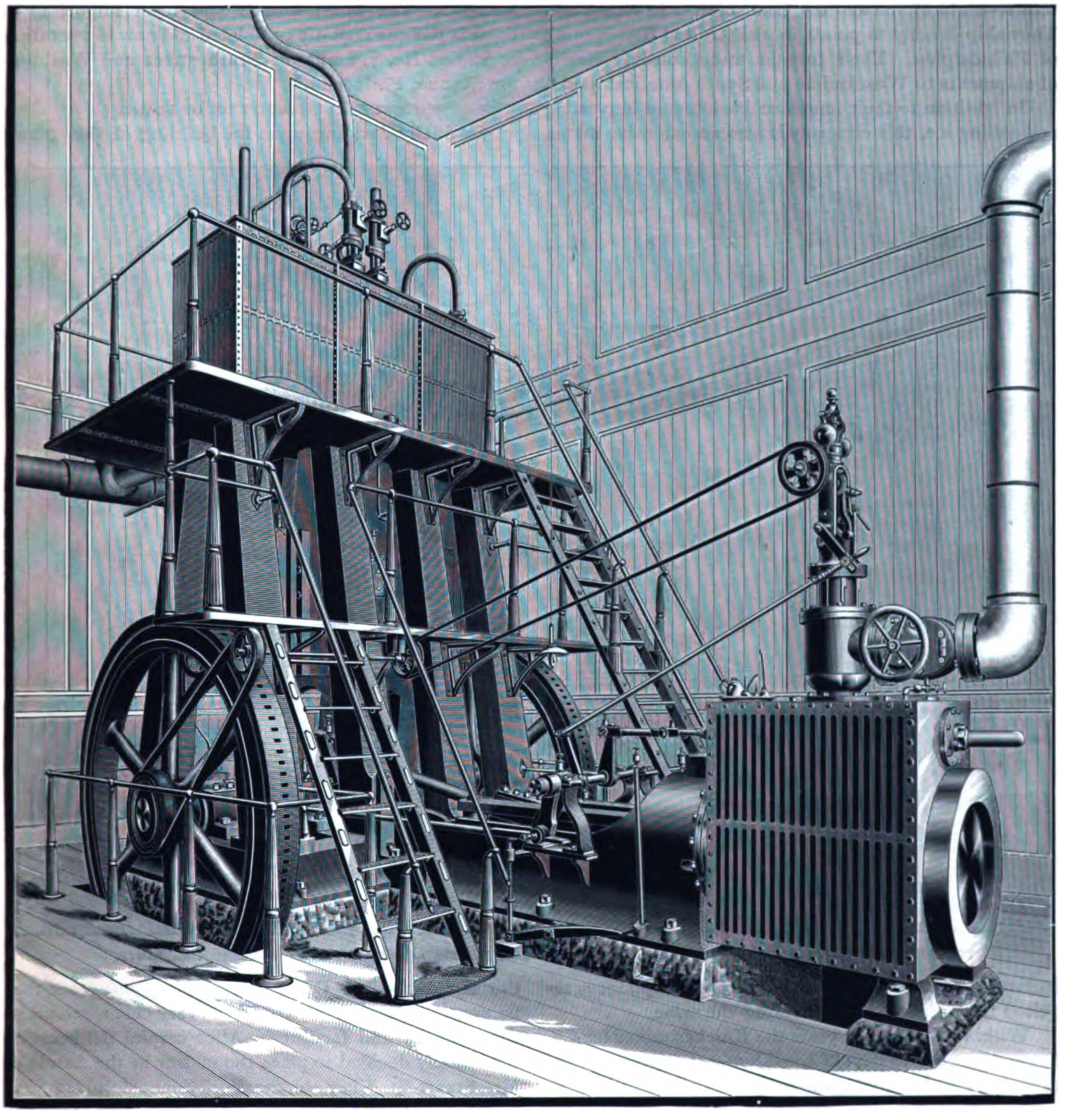
FOR RUSSIA.

M. A. Krupsky, professor of the Technological Institute of St. Petersburg, desires us to say to our readers that in view of his connection with the technical school, he believes he can be of service to Americans as well as Russians by disseminating information of our manufactures in Russia; and to that end asks that manufacturers of machinery send to him catalogues and price lists, addressed to him in care of the Technological Institute at St. Petersburg, Russia.

NEW ICE MAKING PLANT IN THE "CITY OF BROTHERLY LOVE."

THE KNICKERBOCKER ICE CO., PHILADELPHIA, ADD A NEW FACTORY TO THEIR BUSINESS—INTERESTING FACTS REGARDING THE POSITION OF THIS COMPANY IN THE COMMERCIAL WORLD—MINUTE AND DETAILED DESCRIPTION OF THE PLANT—THE WORK OF THE YORK MANUFACTURING COMPANY, LIMITED.

AMONG the most noteworthy additions to the ice making plants of the country that have been erected during the year just closed is the one completed for the Knickerbocker Ice Co., of Philadelphia, by the York Manufacturing Co., Limited, of York, Pa. It possesses many features of a mechanical nature that will command the interest and attention of all who are in any way interested in ice machinery or ice making. Many of the labor saving contrivances are novel in that they are new in their application to this branch of mechanical industry. For this reason, mainly, a careful description of this plant and its machinery will be studied with close interest by all the readers of ICE AND REFRIGERATION.



ST. CLAIR COMPOUND COMPRESSOR, SIXTY TONS ICE MAKING CAPACITY, ERECTED FOR THE KNICKERBOCKER ICE CO.

THE KNICKERBOCKER ICE CO.

There are comparatively few industrial houses in America whose name is so familiar to all classes of people as that of the Knickerbocker Ice Co., of Philadelphia. It is one of the oldest and most successful engaged in the business of harvesting and delivering the handiwork of "Jack Frost." Indeed, if we are correctly informed, the volume of business done annually by this house is as great, if not greater, than that of any other engaged in the same industry in the world. Their ice houses, thoroughly equipped with all the latest and

best mechanical contrivances and appliances for harvesting, are found upon the banks of streams and lakes in many parts of the United States. Their ships and barges, specially constructed for conveying and delivering the harvested product, are known in many of the seaports of the world.

Outside of the city of Philadelphia and contiguous territory the principal houses owned by this company are located upon the banks of the Kennebec and Penobscot rivers in Maine and the Hudson river in New York. They ship largely to points in the United States south of Philadelphia. Their foreign trade consists mainly of shipments to West Indian and South American ports.

In addition to their immense business in harvesting and selling ice, this company is also an extensive manufacturer of ice tools and all mechanical appliances required for handling and delivering the same.

Within the past few years the Knickerbocker Ice Co. has commenced to devote considerable attention to the claims made for the manufactured article, and to the means adopted for producing it. In America particularly, ice is no longer looked upon simply as a luxury. It has become practically a necessity. Old "Boreas" and his attendant sprite "Jack Frost," cannot always be depended upon to attend to business. As a result we have periodical seasons of short and poor crops. Then again, the manufactured article is gaining friends every day, so that it is not at all uncommonly the case that the product of nature's laboratory is passed by for the output of the ice machine.

The Knickerbocker Ice Co., with the accustomed business acumen and conservatism which has made it famous among the commercial houses of the Quaker City, were quick to note the signs of the times and grasp the opportunity to compete with others along this line. They recognized the fact that under certain circumstances and contingencies the ice machine had become an actual necessity. They therefore proceeded to introduce its use into their business, and now have several factories in continuous operation, situated in different localities. The latest, largest and most important of these is the one recently completed and now in operation at Station No. 7, corner of Ninth street and Washington avenue, Philadelphia.

GENERAL DESCRIPTION OF PLANT.

In finally deciding upon the building of this plant, the Knickerbocker Co. determined to spare neither pains nor expense in providing the very best mechanical contrivances and facilities. After careful deliberation they finally decided to place the matter in the hands of Mr. Stuart St. Clair, of the York Manufacturing Co., Limited. He was instructed and given *carte blanche* to produce a model ice making plant.

The location selected possesses every facility for shipment by rail, being immediately contiguous to tracks connected with all trunk lines running out of Philadelphia. Added to this, the fact that many novel features have been introduced designed to reduce the cost of manufacture to a minimum, makes this plant one of the most noteworthy as well as one of the most interesting to the student of ice making economies erected in recent years.

POWER CRANE IN POSITION HOISTING 3,000 POUNDS OF ICE, ERECTED BY YORK MANUFACTURING CO., LIMITED.

These special features, which are fully described herein, betray the well known mechanical ingenuity and original genius of Mr. St. Clair. This gentleman impresses all with whom he comes in contact with the idea that he is especially equipped for the industry in which he is engaged. The business of manufacturing ice and mechanical refrigeration is still in its infancy, and is continuously meeting with new problems and conditions that must be grappled with and solved in order to keep pace with the growing demand from innumerable industries and professions wherein ice or cold is required. This being the case, Mr. St. Clair fills a very large niche in the trade. He is "long" in resource, as well as in stature.

THE COMPRESSOR.

The ice making plant is of sixty tons daily capacity. The compressor, as shown in accompanying illustration, is the pattern widely known as the St. Clair compound, having two low pressure or evacuating cylinders 18×30 inches, vertical and single-acting.

The duty of these cylinders is simply that of evacuation and compressing at low tension, maintaining nearly a constant temperature in the cylinders, thereby saving the large percentage of loss that accrues from highly heated cylinder walls.

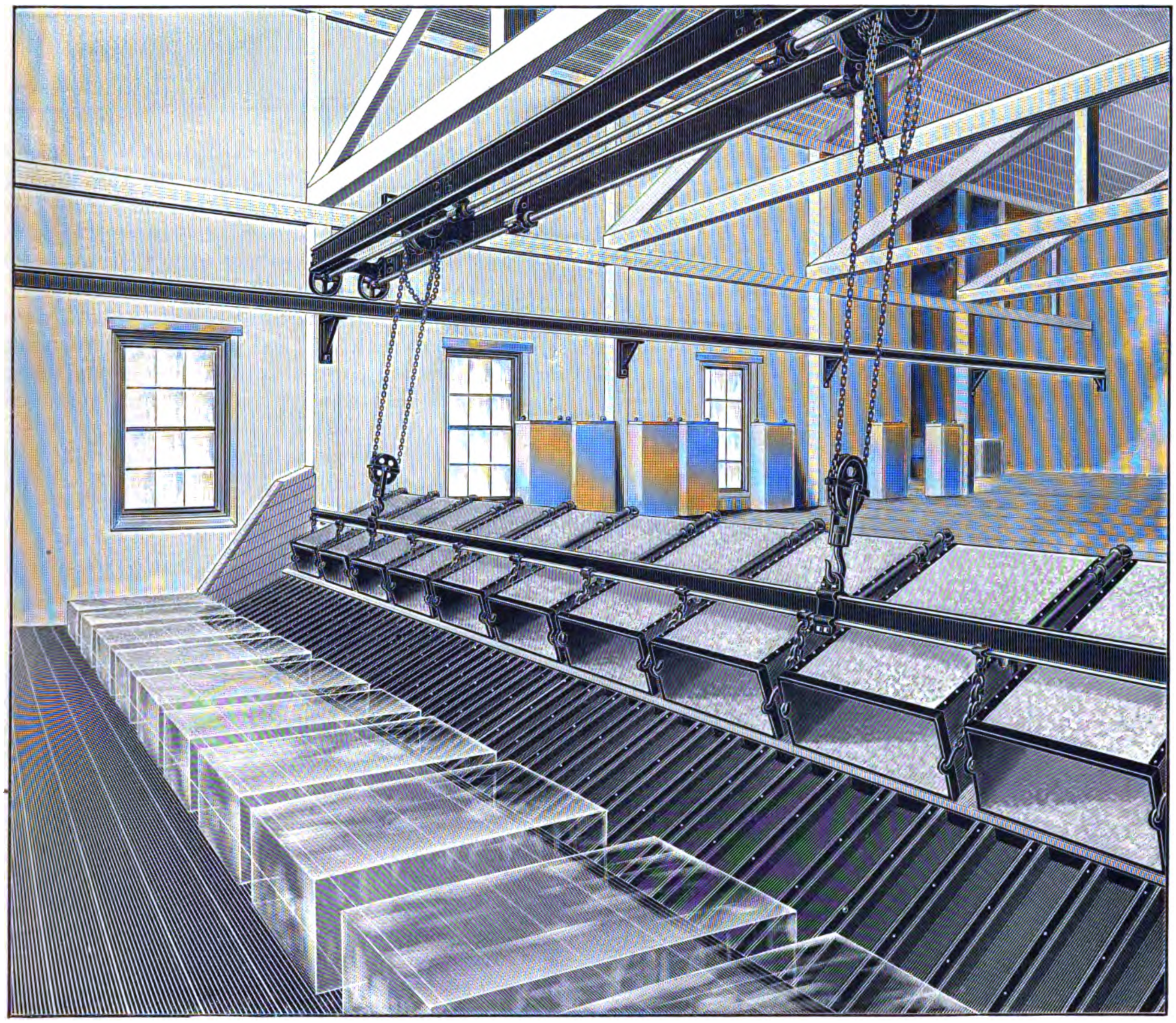
These low pressure cylinders and the receiver of same are water-jacketed. The cranks of these cylinders are set at 180° from that of the high pressure cylinder, and both at 90° from crank of engine.

The high pressure or delivery cylinder is 15×30 inches, and its duty is to simply deliver the partially compressed gas to the condenser.

This cylinder works under nearly constant temperature, and is also water-jacketed, the temperature of the gas at no point in the delivery ranging higher than 130° F.

THE ENGINE.

The compressor pumps are operated by one of the York Manufacturing Co.'s balanced valve engines, 26½×30 inches, controlled by a cut-off governor of their own make. The claim made for the efficiency of these engines is very high, the water consumption per hour per horse power being only twenty-four pounds.



POWER CRANE IN POSITION AT DUMPING PLATFORM DISCHARGING 3,000 POUNDS OF ICE.

Another valuable feature of this single-valve engine is the remarkably low clearance, being only 3.2 per cent.

The engine and ammonia pumps are operated without any internal lubrication whatever, and, we are assured, without any increased friction, demonstrated by careful tests.

PUMP AND ENGINE DIAGRAMS.

We have succeeded in obtaining diagrams taken from

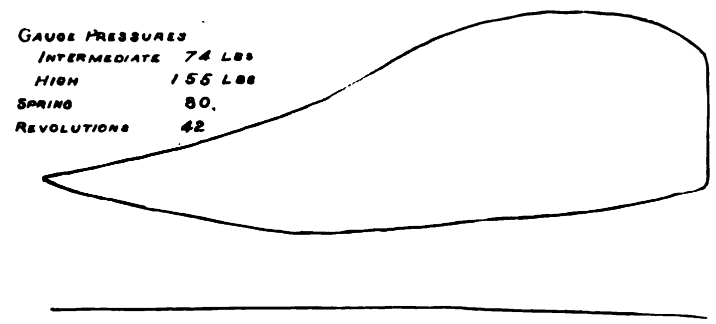
both engine and compressors, which we herewith illustrate, and which fully explain themselves.

With regard to the low pressure pump diagrams, which are the measure of efficiency, they stand about 99 per cent, as shown by the straight line from highest to lowest point.

Another remarkable feature is that no matter how many revolutions the pencil was occupied in taking that card, there was no multiplication of lines, thus demonstrating that the valve action, though voluntary, was as absolute as though mechanical. The engine diagram is also worthy of close attention and study.

The high pressure pump diagram is of no value as a measure of efficiency, but illustrates the prompt action

HIGH PRESSURE PUMP.



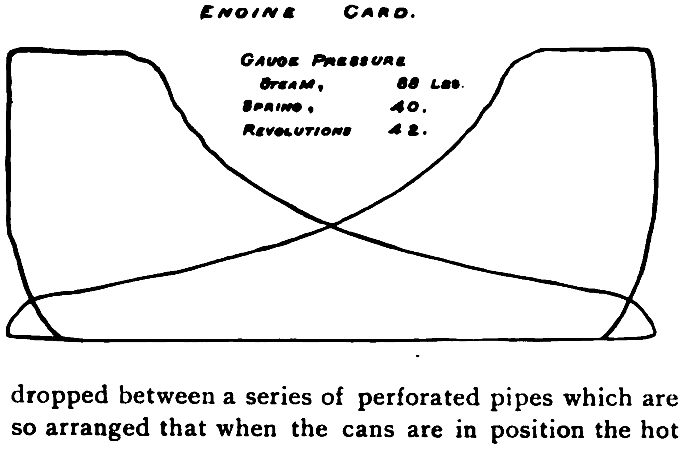
of valves and the small amount of clearance, as shown in the compressors.

The manufacturers inform us that they hold the originals of these cards, and many others equally as good, taken at various times from this same machine, and are glad of this opportunity to place before the public a practical demonstration of what they have so long claimed for their plants.

THE PROCESS OF HARVESTING.

The two illustrations in this article, viz.: "Crane in position raising cans," and "crane in position after discharge of ice," which have been very carefully drawn from original photographs by the special artist of ICE AND REFRIGERATION, very clearly demonstrate the utility and economy of the crane when properly applied in the ice factory. The first illustration shows the crane in position after drawing one row of ten cans from the tank. By means of rope transmission the crane, with its load of cans filled with ice, is then conveyed to the end of the tanks, where, being lowered, the cans rest in an inclined position with their open ends looking down the slide ready for the discharge of the cakes of ice to the dumping platform. In lowering the cans they are

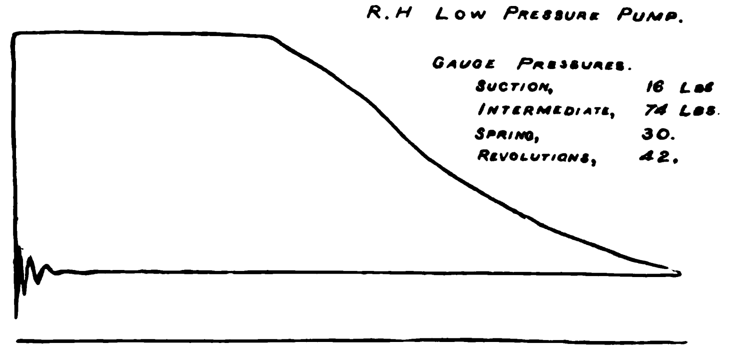
ENGINE CARD.



dropped between a series of perforated pipes which are so arranged that when the cans are in position the hot water ejected from the pipes completely covers and envelops the can.

This power crane is operated by an independent engine which also operates all of the pumps, they being of the power type. It raises ten 300-pound cans at one

R.H LOW PRESSURE PUMP.



lift and is then racked as described above to the incline. The water which is sprinkled upon the cans through the pipes described is the overflow from one of the cooling tanks. The ice is liberated and discharged upon the platform without any more loss than that absolutely necessary to allow them to slip from the cans.

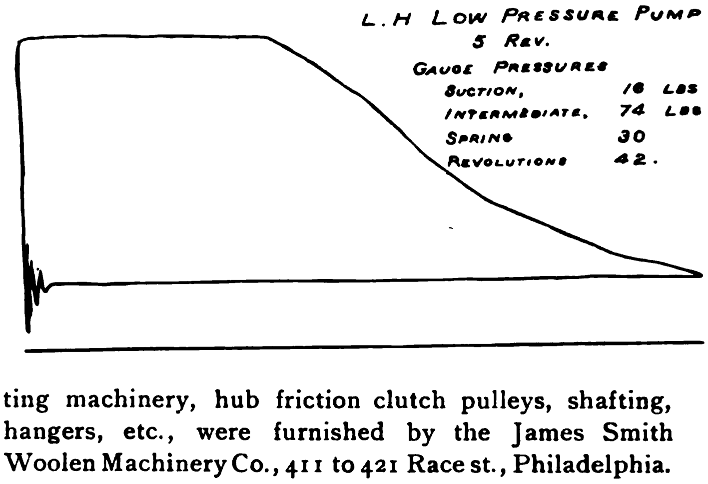
By this means one man can easily harvest thirty tons in his twelve hours' watch, and put same away in storage room, thus reducing the labor to the absolute minimum. Three men on each watch is the total crew required to operate this system at this factory. It will thus be seen that the utmost economy in time and labor has been accomplished by this method. The idea and construction are entirely original in this country with Mr. St. Clair, as applied to ice harvesting, as to our knowledge at this writing there is no other factory in America operated on this plan.

IN GENERAL.

The entire plant is fitted up regardless of expense with the best modern appliances and machinery required to accomplish the best results at a minimum of cost.

All steam and water pipes are thoroughly insulated, also all tanks where necessary. The power transmit-

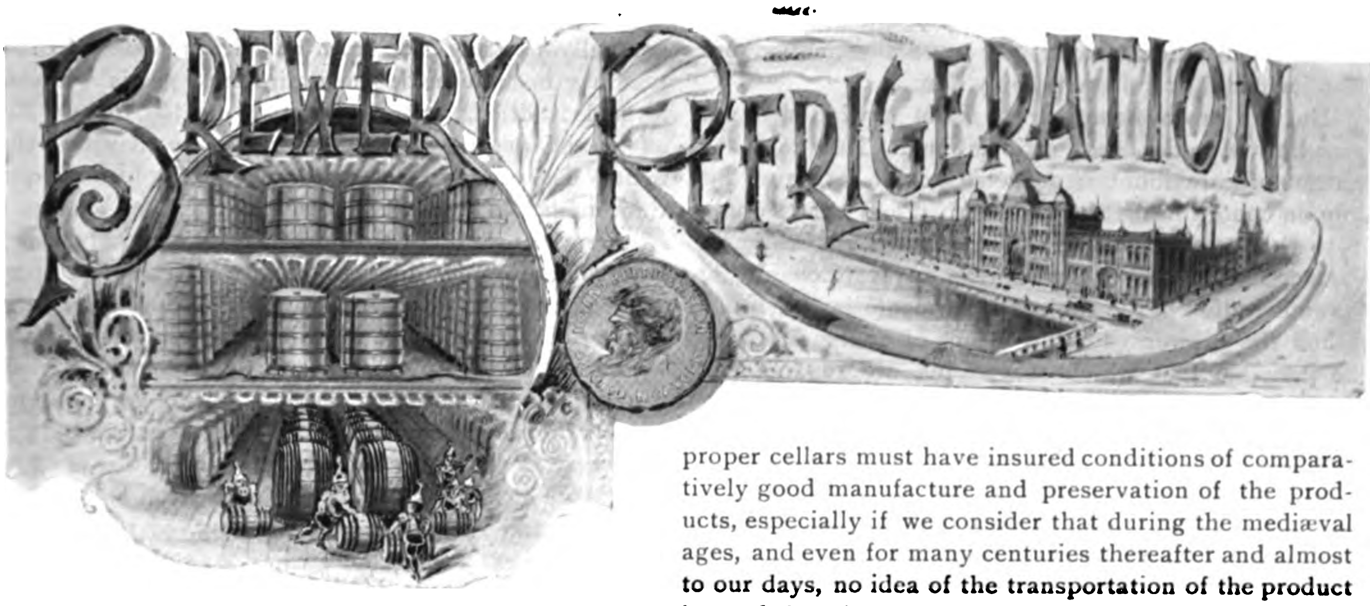
L.H LOW PRESSURE PUMP
5 REV.



ting machinery, hub friction clutch pulleys, shafting, hangers, etc., were furnished by the James Smith Woolen Machinery Co., 411 to 421 Race st., Philadelphia.

Located in the boiler room is a water filter of large capacity, manufactured by the Cummings Filter Co., Builders' Exchange, 18 South Seventh street, Philadelphia. The claims made for this filter in connection with its application to ice making are worthy the attention of ice machine builders and engineers.

In this room are located also the steam surface condenser and re-boiler.



[*Written for* ICE AND REFRIGERATION.]

ARTIFICIAL REFRIGERATION IN BREWERIES.

THE BEER OF OUR ANCESTORS—HOW THE USE OF ICE AND REFRIGERATION HAS CHANGED ITS PRODUCTION—THE MALTING PROCESS.

BY AUGUSTE J. ROSSI, B. S., C. E.

[*Continued from December issue, page 380.*]

THAT the beer of our ancestors was a crude product, and not the well prepared beverage of our day, there cannot be any doubt. A certain care has to be taken during the process of preparation, and the influence of the temperature on the final quality of the liquor is paramount. The fermentation of the liquid must indeed be conducted under special conditions, otherwise it is subject to a multiplicity of alterations, such as acid or viscous fermentation while in course of preparation, and the liquor resulting cannot be preserved for any length of time. Hence we must infer that such beers must have been consumed *in loco*. Later on, when the circumstances attending the phenomena of fermentation were better observed and understood, if not scientifically, yet at least in their general features and significance, the influence of temperature and other agencies must have been better appreciated. We see the brewer adding to his beer certain chemicals in his efforts to arrest undue fermentation and to avoid the deterioration of the product. We see the brewing limited to those seasons of the year when the temperature permitted a more satisfactory brewing, or to the climates and countries more favored on the score of low temperatures. With the same idea in view the brewer sought to insure to his manufacture surer chances of success, and to his product a greater stability, by constructing caves in the sides of the mountain or by digging cellars underground in order to obtain therein a uniform and sufficiently low temperature, even in climates less favored by nature for his purpose. The results of these improvements were, no doubt, a consequent betterment of the quality of the product, and must have led, by logical steps, to the use of natural ice in brewing, wherever this natural commodity was available and could be had in abundance.

How early natural ice was used for this purpose it is difficult now to ascertain. It is obvious, however, that as long as brewing was conducted only in certain seasons and was restricted to certain climates, the use of proper cellars must have insured conditions of comparatively good manufacture and preservation of the products, especially if we consider that during the mediæval ages, and even for many centuries thereafter and almost to our days, no idea of the transportation of the product beyond the place of its production (or practically so), could be entertained, owing to the imperfection of the means of communication and the disturbed state of society in almost all the nations of Europe. Beer was then, and for years remained, a local product, and its preparation was limited by the conditions of climate and to certain seasons of the year, until the advancement of science in all its branches, the diffusion of knowledge, a condition of more real security of society became prevalent in the different nations, the establishment of rapid means of communication—in a word, until the general progress which so strongly characterizes our present century rendered possible the extension and development of all industries, beer brewing with the rest.

The most advantageous and rational manner of rendering the use of natural ice available for the purpose of brewing in our modern time must have been apparent. It was obviously to store the ice where and when it could be harvested in the cold months, keeping it in properly constructed ice houses in order to utilize it to secure lower temperatures whenever the season advanced. Not only did such practice enable the brewer in a given place to brew from one end of the year to the other—a clear gain by frequent turnings of stock—but, beside, within certain limits of distances, when transportation of ice from more northern countries was admissible at a reasonable cost, the benefits of such practice could be extended to locations less favored by nature on the score of supply of natural ice. The possibility of maintaining lower temperatures, thus insuring better conditions of manufacture and a greater stability of the product by the use of natural ice in brewing, must have contributed largely to the extension of this industry. But even under these more favorable conditions this extension was still limited by the cost of natural ice, excluding its economical use in many circumstances and in many locations, and it required the immense progress in all science during the last fifty years to place in the hands of man the means of conquering nature, nay, to compete with her with advantage, even where she is most bountiful in her supply of the natural product, by furnishing him artificial means of securing command of this factor of "cold," controllable at pleasure for the purpose mentioned, everywhere, under the tropics as well as in the temperate zone, at a price lower than that of the product of nature, and to furnish it in such conditions, as

we will see, as to enable the brewer of our day to apply it in a much surer, cleaner and more effective manner than ice could or did ever supply him.

But the improvements in the art of brewing have not been limited to the use of artificial cold. This cold has become of paramount importance to him, it is true, but only on condition that he knows when and how to apply it to the best advantage. The magnificent works of Pasteur and all the bacteriologists in every country in the exploitation of the subject of fermentation have furnished the brewer with the means of contending with the invisible foes which escape his observation, but which are there, watching him at every step, ready to profit by any lack of attention, and to transform his legitimate expectations of success into sad disappointment. There is no branch of manufacture where chemistry has exerted a more decided influence than in the art of brewing, and notwithstanding the old saying, that "any old woman can brew," the brewer of our days knows that he is able to follow his business all the year around only because his art has become so involved with science that it has ceased to be a simple trade and become a science.

"The intelligent brewer of our days," says a technical writer, "must be constantly on the alert, ready to grasp and utilize all the improvements and facilities which are presented by our constantly progressing technical skill." It is no longer sufficient for him to possess "experienced business management," he must depend on assistants possessing a more or less scientific and practical training, wh know "how to turn to the best account all the techr al advantages at their disposal." Among these auxili ies is the ice machine, which is the real subject of tl e papers.

Malting. During the germination of all seeds there is formed, process of oxidation of their most alterable constituents, a pecular substance called "diastase," which is characterized by the remarkable property it possesses of inducing the conversion of starch into dextrine and sugar, which, unlike starch, are soluble in water. The ortance of "diastase" to the brewer becomes apparent; for to the presence of this principle the "malted barley" or "malt," as is called the prod ct obtained from the germination of barley, he finds the very elements required to transform fresh quantities of amylaceous substances of the grain into soluble products which submitted in proper conditions, to a process of fermentation, after the addition of the aromatic and bitter principles of the hops, yields the fermented liquor called beer.

In the process of malting, the grain is first soaked in water and then abandoned in rooms, properly constructed for the purpose, to the germination at a temperature varying from 55° to 62° F. at the most. Spring and autumn in northern or temperate climates are then the most or only favorable seasons of the year for malting, unless some artificial means of refrigeration be used to maintain in the rooms the conditions of moderate temperature required. Even at this first stage of the preparation of the product which is going to form the basis of the brewing, the importance of "artificial refrigeration" asserts itself, since it may allow the maltster to follow his industry from the beginning of the year to the end.

The germination having proceeded for a certain time, generally a fortnight or so, a sufficient amount of diastase has been formed; the grain thus partially transformed is dried, first slowly, then heated to 140° F., sifted and ground and, in this state, constitutes the malt. The operation of malting generallv forms a distinct industry from that of brewing.

Brewing.—In order to prepare beer th ...ashes the ground malt by digesting it with wa at a temperature of 180° F., or thereabout, in appropriate vessels. During this process of mashing, the diastase of the malt transforms into glucose and dextrine such part of the grain as had not been changed during germination, but, as the malt contains much more diastase than is necessary to convert its starch into sugar, this is taken advantage of by the brewer, who adds fresh non-malted barley during the process of mashing, of which fresh barley the amylaceous constituents, or starch, are transformed, in their turn, into dextrine and sugar by the excess of the active principle of diastase. It is at this stage of the process that other grains besides barley have been added; even potato starch has been used for such purpose in Belgium.

Wort.—The product of the "mashing" is the wort. It contains, besides glucose, dextrine and diastase, nitrogenous compounds formed from the albuminous matter of the barley, compounds readily fermentable and subject to rapid alterations. The wort is then boiled with a decoction of hops. Among the different substances which hops contain two are particularly useful for the purpose of brewing—the essential oil and the bitter principle. The first acts as an agent of preservation, the second communicates to the liquor this bitter and aromatic taste which characterizes beer. The bitter principle of the hops could be replaced by other soluble substances; it has even been done occasionally, but always, more or less, to the detriment of the palatable qualities of beer. The essential oil of the hops is soluble in water, a precious property for the manufacture of beer. [TO BE CONTINUED.]

BREWERY REFRIGERATION NOTES.

——The Schmulbach Brewing Co., Wheeling, W. Va., are building a new ice house to replace one recently burned.

——The Hamilton Wine and Beer Co., Keokuk, Iowa, are rebuilding their storage depot, recently burned.

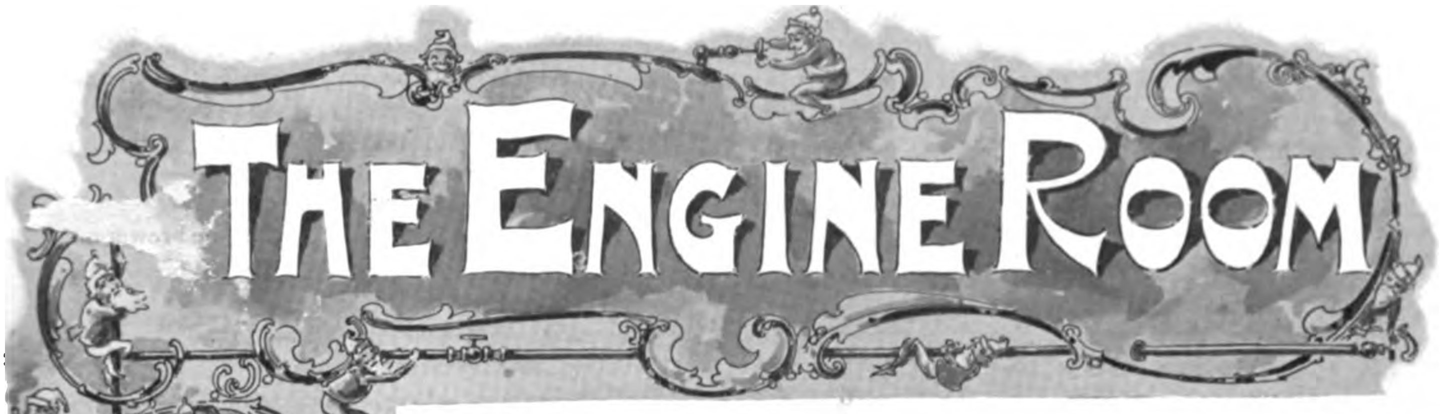
——The Pabst Brewing Co. are building a 900-barrel cooler at Dubuque, Iowa.

——The Anheuser-Busch Brewing Association has purchased land at North End, O. T., on which to build a beer storage depot.

——The W. J. Lemp Brewing Co. will build a depot building at Quincy, Ill., to be 25×60 feet in size, two stories high.

——Geo. Doehne, of Harrisburg, Pa., has made a contract with the Pennsylvania Iron Works Co., Philadelphia, for the erection in his brewery of a 20-ton refrigerating machine.

——A new ice company, known as the Lake Superior Ice Co., has been organized at Marquette, Mich., the principal stockholders of which are Edward Ryan, C. J. Hodge, Thomas Smart, Paul Roehm and James Allen. Mr. Allen, who now has a business at Marquette, will act as manager, and his present business will be merged into that of the new company. The company will supply ice to Hancock, Houghton, Red Jacket, Calumet, Tamarack, Osceola, Lake Linden and Dollar Bay, Mich. The Calumet and Lake Linden house will be kept at the former place; ice will be cut from Mr. Allen's present field near the Atlantic where enough ice for the Portage Lake towns will be cut. Another field will be prepared in Big Portage, where the product will be loaded directly on to the cars for transportation to Calumet and Lake Linden. Ice will also be cut in Lake Superior. The company also have in prospect the running of a cold storage establishment during the summer months, which will be situated in Calumet or Red Jacket. Besides dealing in ice at retail the company will take contracts to fill private ice houses.



[*Written for* ICE AND REFRIGERATION].

GASES IN ICE MACHINES.

DECOMPOSITION OF AMMONIA IN REFRIGERATING MACHINES — HOW DECOMPOSITION OPERATES IN THE SYSTEM — HOW TO GET RID OF THE OBJECTIONABLE GASES.

BY CHARLES DESMOND.

THE decomposition of ammonia in refrigerating machines has given rise to the supposition that the gas is inflammable and under certain circumstances explosive. This is a mistake, for although ammonia is composed largely of hydrogen gas, which will burn readily in presence of air or on admixture with oxygen, it cannot be ignited when in combination with nitrogen, as is the case when they form ammonia. The chemical composition of ammonia is three volumes hydrogen and one volume of nitrogen; but the bulk of the compound is but two volumes, for in combining a shrinkage of one-half takes place. By weight, the compound is three parts hydrogen and fourteen parts nitrogen.

Ammonia is easily decomposed by heat, and this accounts for the inference that it is combustible; but the fact is that the only combustible part is the free hydrogen. Ammonia decomposes slowly but quite perceptibly at the temperature of boiling water, and more rapidly at higher temperatures. At the temperature of about 750° the decomposition is so rapid as to be almost instantaneous. If ammonia gas is passed through a tube fourteen inches long, heated to a faint red, the decomposition will be complete, and the hydrogen which it contained can all be burned when in contact with the atmosphere. In the majority of ammonia refrigerating and ice making plants, a jet of the gas drawn from any portion of the system can be ignited if a flame of sufficiently high temperature be applied; but unless there is free hydrogen, due to the decomposed ammonia, the flame cannot be maintained, and it will cease as soon as the igniting flame is removed.

A certain proportion of decomposed ammonia may be found in all ammonia systems, as might be expected, on account of the low temperature at which it is decomposed; and the less inflammable gases found, the stronger the indications that the system has been receiving the proper care, although this precept is not wholly applicable in the case of absorption systems; for, owing to the nature of that system, inflammable gases are always found mixed with the ammonia, even if the ammonia has shown the usual degree of purity before being introduced into the system. The fact that a continuous flame can be maintained from the escaping gas from an absorption system leads those in charge of such system to contend that ammonia gas is inflammable, because they are judging from their own experience without having a full knowledge of the nature of ammonia. But their belief is justified, to some extent, when they can ignite a jet and find it will burn with a long flame, showing that the decomposition is not due altogether to the heat of flame by which the gas was ignited; and the color of the flame is characteristic of hydrogen, but tinged in a way by gases due to the decomposition of organic matter, which gives a reddish hue, but separated apparently from the hydrogen flame.

The presence in the system of the gases from the decomposed ammonia, hydrogen and nitrogen, is detrimental to the efficiency of the plant, because they then occupy double the volume which they did when combined; and the specific heat is less than one-half, so that by the absorption of heat when expanded they have only a small part of the capability of the same weight of ammonia, it being reduced greatly by the lack of latent heat. Neither hydrogen nor nitrogen has any latent heat under these conditions, for the gases are not subject to such pressure and temperature as will cause them to liquefy; consequently the latent heat will not be developed, and the only effect due to their compression and re-expansion will be that of a small amount of heat that is squeezed out of them—less than 8 per cent of what the same amount of work would accomplish if expended on pure ammonia.

It is most desirable, then, to keep the system free from both hydrogen and nitrogen as well as air, for their presence is most detrimental to the economical action of the system, the work required for the same amount of refrigeration being greatly in excess of that necessary when only ammonia is present. The amount of cooling water also must be greatly increased when any portion of the ammonia has become decomposed and the gases are still in the system. The detrimental effects of decomposed ammonia in the system, even

though the amount be small, can be readily determined by calculating the enormous power which would be required to do the work with these gases alone.

The ammonia combination once broken up cannot be reformed; for hydrogen and nitrogen will not combine unless they are brought together under proper conditions of temperature when the gases are in the nascent state; that is, when they are just released from chemical combination with some other element, as in case of destructive distillation of animal or vegetable matters from which ammonia is obtained. From the above it is evident that when ammonia has once become decomposed in the system, there is no chance for it to reform; and the gases will then remain a constant detriment to the economical working of the plant. How to rid the system of these gases with the loss of the least amount of ammonia, is a question of great importance and worthy of careful consideration. The decomposed portion is a loss from the start, and the sooner it is removed the greater will be the economy, even though its place must be filled by fresh ammonia, and the sooner it is done the better.

In considering the properties of the different gases, we find some points of which we can take advantage and which will enable us to greatly purify the remaining ammonia. The specific gravity of these gases differs greatly, so that we can make use of this property to aid us.

The specific gravity of ammonia gas, as compared with air, is .589, or little more than one-half, so that ammonia gas would always rise to the top in a mixture of air and ammonia. The specific gravity of nitrogen is nearly as great as that of air, so that when it is present in the system with ammonia it will settle in the lower portions if not too greatly disturbed. Hydrogen has less than one-eighth the weight of ammonia, and will always find the highest portions of the system, from which it can be drawn off with but slight loss of the ammonia gas. The top of the condenser is, perhaps, the best place for the tap by which the lighter gases are to be removed; while the nitrogen, or heavier gases, can be drawn from a trap, or pocket, in the return pipe, near the compressor, where there is little if any liquid present. No trouble will be experienced in getting rid of the hydrogen without waste of ammonia, but in case of nitrogen the operation is somewhat more delicate, and some waste of ammonia will be unavoidable, although the loss will not amount to nearly so much as the gain derived from having only ammonia in the system.

When removing either of the gases, they should be drawn off through a hose and made to escape into a tub of water, where the bubbles caused by the escaping gases may be watched, for this is the best indication that such gases are still escaping. Neither of the gases which combine to form ammonia will mix with water, while water will readily absorb ammonia. This fact gives us a means of detecting the escape of ammonia, for the absorption of ammonia is so rapid that a hissing or crackling sound is produced similar to that made by the escape of steam under water. Better results can be obtained from drawing off the gases frequently and stopping the flow as soon as the escape of any ammonia is detected, rather than trying to remove it all at one time.

Engineers in charge of refrigerating plants will understand that the lower the temperature of the ammonia is maintained, the less will be the amount of the decomposition; and if the pipe leaving the compressor is not permitted to become so hot as to feel uncomfortable to the touch, there will be no decomposition to amount to anything worthy of attention.

The presence of decomposed ammonia in the system can be detected in different ways, particularly by trial, as described above. It is indicated if the pressure on the system differs greatly from that due to the temperature of the surroundings, after the machinery has been standing for some time. This test is reliable only in cold weather, when the temperature outside is about the same as that maintained in the plant.

[*Written for* ICE AND REFRIGERATION.]

SOME LOSSES IN REFRIGERATION.

THE LOSSES BY LEAKAGE OVER-ESTIMATED—EXPERIMENT TO FIND THE AMOUNT OF LOSS—FALSE ECONOMY OF SMALL TANKS AND INSUFFICIENT PIPING.

BY OTTO LUHR.

WHEN studying the theory of refrigerating machines, if we take the text too literally, we are liable sometimes to get a little "off" in our conclusions when we attempt to put the theories into practice. To illustrate my meaning, we will take, for instance, the losses as they are generally determined in theory and as we find them in practice.

Different authorities give the losses in the compressor as due to its imperfect working, such as clearance and leakage of the valves and piston, as amounting to 15 per cent. Judging from my own experience, I believe this is too much, unless the clearance is much more than usual. The leakage of piston and valves is hardly noticeable in the machines I have in charge, in spite of the fact that the valves have not been ground in nor the piston rings adjusted for many months. Not long ago I packed the stuffing box on the rod of a Linde compressor, and thought I would experiment a little while doing it. There was full pressure on the system, and I left the discharge stop valve open to see how much leakage there was to the check valve. After closing the stop valve on the suction, I slacked up on the stuffing box bolts and let out the gas that was in the compressor, and was very much surprised to find that the valves did not leak "a little bit," and there was no leakage past the piston, although there was some pressure in the opposite end of the cylinder. Any one who has packed the stuffing box on a compressor knows that it would have been impossible for me to have done the work if there had been any leakage through the valves or piston. The Linde machines have horizontal compressors and the usual long stuffing box, using oil. In this case I infer that the small amount of oil that mixes with the ammonia is sufficient to prevent the small leaks by keeping the valves and rings tight enough to prevent the passage of the ammonia gas. Oil is slower to move than ammonia, and the film that covers the valve seats and the walls of the cylinder answer in lieu of joints that are sufficiently tight to prevent the passage of ammonia gas, and which must of necessity cause considerable friction.

When a system is not working satisfactorily or economically, it is customary to lay the fault to the compressor, when in fact the defects are in the system in general. I have often found that a great defect in some

systems was in the brine tank being too small in proportion to the compressors, making it necessary to carry a low back pressure, in spite of which the temperature of the brine was high. This defect is to be avoided by all means. The pipes in the brine tank are about eight inches apart, and the heat passes though the metal slowly. Again, the ammonia requires some time to evaporate, for a great number of heat units must work their way through the metal of the pipes and be absorbed by the ammonia before it can become gas and exercise its full power as an absorbent of heat. The brine, too, requires time in which to absorb the heat from the surroundings, so that the rapidity with which it is forced through the system, on account of too small a supply, acts as a detriment and is not at all economical.

An insufficient amount of pipe surface in the cooling rooms is also a frequent cause of the system working poorly and not giving satisfaction. Liberal allowance of pipes in the rooms is economy in the working of the plant; for the extra amount of fuel required, where the pipes and tanks are too small, would much more than pay interest and depreciation on a sufficiently large tank and the proper amount of pipes. What is the difference if a few feet of extra pipe are put in, with the necessary valves? They can be used or not, as may be found necessary, and they will more than pay for themselves in the amount of fuel saved when rapid cooling is required. I have a liberal supply of brine and plenty of pipes, and I find economy in having them.

The theory of this subject, as usually explained, does not give a full explanation of these points in a manner clear enough to be readily understood by the majority of readers, and for this reason these minor items, on which so much depends, are not given sufficient consideration by those who install the plant; and the natural consequence follows, that the plant does not meet the expectations of those who have purchased it, and the engineer is often blamed for the faults of others.

A case which illustrates this is that of a plant at not a great distance from where I am located. The system was not doing the work which it was guaranteed to do, and it was evident that there was a fault somewhere, but where was not so easily determined. Many experts were called to make an examination and render an opinion as to the cause of the plant not being able to do the work. Those of the experts whose experience consisted of shop and office work contended that the fault was in the compressors' not being kept in good working order, while those whose experience had been with such machines in every-day work agreed, without exception, that the greatest fault was in the lack of sufficient pipe surface for the amount of space to be cooled; or, in other words, the amount of work required.

[If engineers are having trouble with their machines, or the system in general, they should make their trouble known in the columns of ICE AND REFRIGERATION, by which means they would then get the opinions of practical engineers as to the cause of the difficulty, and we would all be able to learn something that, perhaps, we do not know at the present time. The next time I write I will tell something about what I think is the proper amount of piping to put into a room, and why I think so.]

——The Thurston Cold Storage Co., St. Paul, Minn., has increased capital stock to $170,000.

[*Reprint from* EXCHANGE.]

BOILER FIRING AND MANAGEMENT.*

PROGRESS MADE IN THE DEVELOPMENT OF THE BOILER—BENEFICIAL EFFECTS OF CHANGES LOST OR MINIMIZED BY THE LACK OF SKILL OF THE FIREMAN.

By D. ASHWORTH.

MY observations, extending over a quarter of a century in a practical and professional way, have presented opportunities to note a continuous decline in the grade of service of firemen and boiler room managers, these operatives seeming to have remained in *statu quo*. The evil has become so glaring and the results so fraught with disaster, destruction and waste as to warrant an effort to call the attention of those who desire to progress to the false and inconsistent position they occupy by permitting such a narrow policy in management, ignoring the fact that better intelligence renders more valuable and more profitable service.

During the past ten years the concentration of efforts by scientists and eminent mechanics looking to the more perfect development of the steam engine has produced results which challenge the admiration of the most critical. In the same period there have been a multitude of features in the designs and application of boilers, all converging to increased economy, efficiency and safety. In the engine sphere, condensing, compound and triple expansion engines, with and without jackets—all the necessary refinements—have received and are receiving close attention. In the boiler domain there has been the evolution from plain cylinder to tubular, and from that through the multifarious forms of water tube, each striving for a superior degree of excellence. Combining these forces, the engine and the boiler, the amount of research and practical application that have been and are being applied for efficiency and economy is incalculable, and these efforts have been of an exceedingly fruitful character.

Notwithstanding these favorable features, we are radically defective at the very threshold of this field, by reason of relegating the firing of boilers to the most ignorant of operatives; or, to put it plainly, there seems to be an idea that any one who can shovel fuel is good enough for a fireman. Close observation and contact with numerous plants of varied character increase this conviction.

Recognizing, as we all do, that the furnace is the source of power, does it not follow that this is the very point that should be treated with every consideration of intelligence? Should not the fuel, furnace and boiler receive the thoughtful attention that the engine receives from the careful engineer? This will be accepted by every one interested in advanced ideas. No one will question the importance of the boiler and its furnace, nor that, upon its mismanagement, the efforts of refinement are rendered, in many cases, completely void. It would seem so simple that argument would be unnecessary, were it not that on every hand the matter is entirely ignored. Are not the efforts of the best furnace designers completely set at naught often by reason of the

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*Abstract of a paper read before the Engineers' Society of Western Pennsylvania, November 21, 1893.

manner in which they are operated? Is it not a glaring fact that in all cities where smoke abatement has been and is being attempted, the great stumbling block is the low grade of intelligence and indifference of the operatives?

In looking upon this subject from a mechanical and engineering standpoint, we are fully alive to the requirements for complete combustion and thorough distribution of heat units; proportion of grate area and openings, proper amount of air, conduction of the heated gases, are all carefully considered. When all is completed, we have the spectacle of these conditions being turned over to the treatment of ram-jam shoveling and slice-bar operations. The fireman should know at least the elements of combustion — the importance of proper management of fires to produce the best results with the least expenditure of fuel. The intelligent engineer keeps this constantly in view as to steam economy; the valves, etc., receive his unremitting attention—unless he should be a mere starter and stopper, for such a so-called engineer can properly be placed upon the same plane as the fireman that shovels without intelligence or judgment.

It may be said that this is being greatly overcome by the application of mechanical stokers, a point that is frequently claimed by those interested in placing stokers. This is a great mistake, well known by those conducting tests, the results always being superior with the greater intelligence of the operator.

This deplorable and absurd state of affairs is doubly aggravated by not simply indifference but actual encouragement, based upon the idea that any one can shovel fuel. Or perhaps it is the idea of "You put it in the slot, and we do the rest." Does it ever occur to these proprietors, or the superintendents of manufacturing establishments, that while they are straining at gnats in the refinements of every application in the various departments looking to economic results, right upon the threshold they are swallowing a camel with the greatest ease?

Within the past few years, in every community where cleanliness, taste and health are considered, there has come forth a crying appeal to the authorities to lessen the great evil of smoke in the atmosphere. In response to this, inventive genius has promptly come forward. The multitude of devices that have been perfected and put in operation furnishes ample testimony of this fact. Many of these, when properly operated, give satisfactory results in smoke abatement, but no inventor has ever had the temerity to label his machine or furnace, "No skilled fireman required." On the contrary, it is well known that the most intelligent fireman produces the best results, and it is also an undeniable fact that the best devices are set at naught by incompetent operating. The writer has been brought into contact with large fields of boiler practice, and in many cases, aside from other disqualifications, the firemen were unable to speak or understand a word of English. It may be said that these men are not paid to think, but to do. Well, they *do* do. They will do up a coal pile, furnace and boilers with alarming rapidity—alarming to those whose views are broad enough to consider the important points. On the other hand, it is a lamentable fact that there are a great number of men in official positions, as superintendents and proprietors, who seem to be utterly incapable or unwilling to note the importance of the necessity for a higher grade of labor in the firing and management of boilers.

One of the most surprising features in connection with this state of affairs is the tendency of those interested to place boilers claiming among their numerous merits that of less attention required than others, on the old exploded idea applied to engines, "No skilled engineer required." I have now before me a letter from a boiler representative who claims that his boiler will give the utmost satisfaction with one-half the attention that others receive.

What is needed at present is to lay aside the idea that any one is good enough to fire and manage boilers. When you engage a man for your office, do you not require that he shall possess some qualifications for the position? and if aptness is shown, do you not show appreciation by advancement to a higher plane, the interest being mutual? Why not apply this to the selection of firemen? As it now stands, we cannot but exclaim:

> "Strange, what a difference there should be
> 'Twixt tweedle-dum and tweedle-dee!"

There are many plants where, by incompetency in this line, the steam efficiency is greatly lessened, furnaces and boilers working in neglected conditions, fuel wasted and the community begrimed with volumes of unnecessary smoke, and in addition to these evils, that of jeopardizing lives and property. Unless this matter is considered, and action taken to improve this corps of operatives, it would seem absurd to be continually reaching and extending into the higher refinements of steam engineering.

Under these conditions, does not the question present itself to the employer, Are we not occupying a false position by this seeming indifference? Do we not retard the development of a class of labor which, by a recognition, by an appreciation that some skill and judgment are required, would be animated by the smallest spark of ambition to qualify for advanced positions? Is not this condition of affairs a gross inconsistency, nay, a mockery, in the face of the query put by those guilty of this indifference: Why can we not get better men than this? In reply I would say, It is not sought on your part. Just as long as this class of operatives is looked upon as mere shovelers of coal and carriers of water, ignorance, with all its attendant waste, destruction of property and general demoralization, will be prominent in the boiler department.

As a fitting close it would be proper to ask what degree of intelligence or knowledge would qualify one to fire boilers properly: (1) That the fires should be maintained with uniformity, and that no openings in the form of bare places show upon the bars to permit the cold air to pass through. (2) The judgment that will enable him, by a glance at the ash pit, to know at once to a great extent the condition of the fires. (3) He should know something of the various fittings of the boilers and the details of the furnaces. (4) An ambition to grasp the details, so as to qualify him for a still higher plane, which would certainly follow, provided there was judgment enough in his superior to note such details.

——The Ansonia (Conn.) Ice Co. has elected E. A. Upson, Bridgeport, president; Moses H. Belknap, Ansonia, secretary and treasurer

[*Written for* ICE AND REFRIGERATION.]

WET COMPRESSION.

THE CARNOT AND THE LINDE CYCLES — ILLUSTRATION AND EXPLANATION OF WORKING PROBLEMS OCCURRING WITH THE COMPRESSION MACHINE.

BY GEO. RICHMOND, M. E.

WE are now prepared to examine in detail the various cycles of operation occurring in the compression machine.

The Carnot cycle, in which the path of the agent consists of two isothermals and two adiabatics, first demands our attention, for in the heat engine, where the object is to convert heat into work, it is easily seen from the heat diagram to be the cycle of maximum efficiency. It does not follow that it must be the cycle of maximum efficiency in the refrigerating machine; indeed, the contrary would seem at first sight to be true. Nevertheless, if we regard the refrigerating machine as engaged in removing heat from a fixed temperature which is usually the practical requirement, the Carnot cycle is more efficient than any other possible under the imposed condition.

For example, it might seem more advantageous to cause the agent to follow the cycle 1234 (Fig. 1), rather than the Carnot cycle 123'4', since less work would be done. But along the paths 23 and 41 the agent is rejecting heat, and as all this heat must be imparted to the refrigerator the effective refrigeration, instead of being the rectangle below 12, is less than the rectangle below 4'3'. If we suppose that a portion of the heat rejected along 23 and 41 is imparted to some body intermediate in temperature between the condenser and the refrigerator, then we are working with a higher condensing temperature than the conditions call for. Subject, therefore, to the condition that all the heat constituting the effective refrigeration is to be taken at the highest available temperature, and rejected at the lowest available temperature, the Carnot cycle is the most efficient, and for this reason may conveniently be taken as the standard of reference by which the relative efficiency of other cycles may be compared.

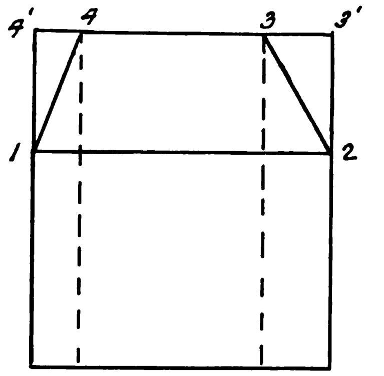


FIG. 1.

The diagrams for the Carnot and Linde cycles (wet compression) may be very easily obtained; it is only necessary to draw horizontals (isothermals) at the two extreme temperatures, namely, of the condenser and the refrigerator, and from the points where the isothermal of the condenser cuts the curves A and B draw two verticals (adiabatics) down to zero temperature. (Fig. 2.)

These latter will cut off from the refrigerator isothermal the portions marked α and β.

To draw the compression and expansion curves on the work diagram, the following fact is sufficient, and, moreover furnishes a ready means of transferring any line from one diagram to the other:

"*Corresponding points within the two closed areas divide the horizontals through them in the same proportion.*"

The reason for this is obvious; if any point, such as k, be taken on a line AB then the fraction $\frac{Ak}{AB}$ indicates the percentage of the agent which is in the state of gas (the remainder $\frac{kB}{AB}$ being the percentage of liquid). It is evident that the volume of a unit weight of the mixture has the same ratio to the volume of a

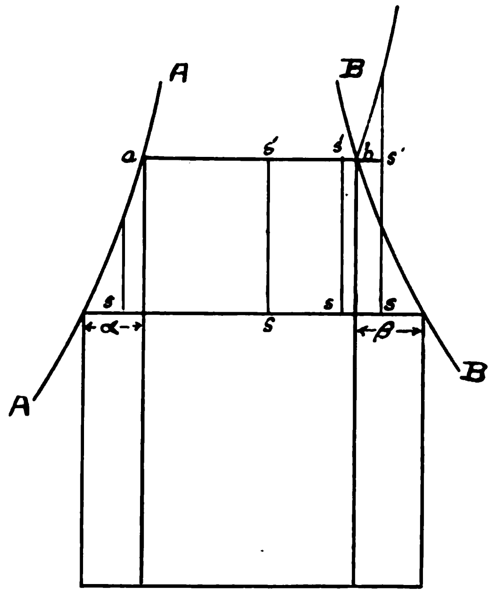


FIG. 2.

unit weight of gas (omitting the volume of the liquid portion, which is very small). We thus readily find as many points on the compression and expansion adiabatics as may be judged necessary for correctly drawing them.

Any problems can now be solved by construction and checked for closer accuracy by the table in ICE AND REFRIGERATION for November.

Ex. 1.—The condenser temperature being 80°, and that of the refrigerator —30°, what per cent of the ammonia brought into the cylinder must be in the form of liquid?

For $T_1 = 80° \ldots B_1 = .1936$
For $T_2 = -30° \ldots B_2 = .0224$

$$\beta = B_1 - B_2 = .1712$$
$$\text{Also } AB_2 = 1.3343$$
$$\text{Per cent of liquid, } \frac{\beta}{AB_2} = \frac{1712}{13343} = 12.8$$

As the temperature rises by compression, the percentage of liquid decreases as follows:

Refrigerator temperature..	-30°	-20°	-10°	0°	10°	20°	30°	40°
Per cent of liquid.........	12.8	11.6	10.5	9.3	8.1	6.9	5.8	4.6

Each of these numbers is the result in the above problem when —20° etc., are successively taken for the refrigerator temperatures. At the end of the compression there will be no liquid, provided a suitable proportion has been introduced at the first. If the mixture contains too much liquid, some will remain over at the end of the compression, and if too little the ammonia will be superheated to a certain extent. The former result is particularly to be avoided, for the liquid clings to the piston and sides, and on the return stroke re-evaporates. So far as the writer's observation goes this fault is very common in American practice with the wet compression system.

Ex. 2.—The condenser temperature being 80°, and that of the refrigerator 10°, if the ammonia entering the

cylinder contains 15 per cent of liquid, what will be the composition of the mixture at the end of compression?

First.—By construction (see Fig. 1): Measure from B 15 per cent of AB_2, and through this point s, draw a vertical line (adiabatic) meeting AB_1 in s', then $\frac{sB}{AB_1}$ is the per cent of liquid at the end of compression, and $\frac{sA}{AB_1}$ the per cent of gas.

Second.—By calculation:

Let $x =$ percentage at end of compression.

$$s'\,B = x\,A\,B_1$$

$$\text{Also } s\,B = .15\,A\,B_2$$

$$\text{But } sB - s'\,B = \beta = .15\,A\,B_2 - x\,A\,B_1$$

$$x = \frac{.15\,A\,B_2 - \beta}{AB_1}$$

In the present case

$$AB_2 = 1.1688 \quad AB_1 = .9353\ \beta = .0947$$

and $x = 8.6$ per cent liquid.

Ex. 3.—The condenser and refrigerator temperatures being the same as in the last example, if the mixture on entering the cylinder contains 5 per cent liquid, what is the condition at the end of compression?

First.—By construction (see Fig. 2): Measure off $s\,B = .05\,AB_2$, and draw a vertical through s. It falls outside of AB_1, showing that the gas is superheated at the end of compression. It became saturated at the temperature at which the vertical (adiabatic) crosses the curve B. To find the temperature to which it is superheated we must remember that the pressure remains constant. Now, the line of equal pressure is a definite curve similar to A, but steeper, the travel to the right, α', being .50836 α, for the same rise in temperature. It may be constructed once for all, and cut out in wood, so as to form a curved triangle, and will be of great use when we consider the superheating cycles. Having provided ourselves with this curved triangle, we slide it along until the curved edge passes through the point b, where AB and the curve B intersect. The intersection of the curve with the vertical, through s, will mark the temperature to which the gas is superheated.

Second.—By calculation: Produce AB_1 to meet the vertical in s', then

$$s'\,B = \beta - s\,B$$
$$= \beta - .05\,AB_2 = \beta' = .0362.$$

It will be shown hereafter, in considering superheating, that the rise in temperature is given very closely by the formula:

$$t_2 - t_1 = \frac{2\beta'(t_1 + 460)}{1.017 - \beta'} = \frac{.0724 \times 540}{.981} = 40^\circ \text{ nearly.}$$

That is, the ammonia will be superheated 40°, or the final temperature at which it leaves the compressor will be $120^\circ = 80 + 40$.

Ex. 3.—The temperature conditions remaining the same if the mixture contains 88.12 per cent of liquid, what will be the final condition at the end of compression?

First.—By construction: Proceeding as in Ex. 2, we shall find that the adiabatic $s\,s'$ will cut the curve A at the point a (Fig. 1), showing that at the end of compression the cylinder will contain liquid only.

Second.—By calculation: Proceed as in Ex. 2; x will become equal to 1, since $88.12\,A\,B_2 - \beta = A\,B_1$.

Ex. 4.—If the mixture contained 10 per cent gas and 90 per cent liquid, what would be the result of compression?

First.—By construction: The adiabatic $s\,s'$ will cut the curve A before the condenser temperature is reached, showing that the whole contents of the cylinder will become liquid before the condenser temperature is reached, namely, the temperature at which the adiabatic, through s, cuts the curve A.

Second.—By calculation:

$$s\,A = .1\,A\,B_2 = .117$$

And this is the travel to the right by following the curve A from the refrigerator temperature to the temperature at which the mixture becomes all liquid.

$$A_{10} = .1125$$
$$\text{Add} \quad \underline{.117}$$
$$A_x = .2295$$

From the table we see that the temperature for which the value of A is .2295 is 68° about, so that x, the highest temperature which can be reached by compression, is 68°.

Since of the curves A and B one is inclined to the right and the other to the left, it is evident that an adiabatic can be drawn so that it cuts both $A\,B_1$ and $A\,B_2$ in the same proportion. In this case the mixture will have the same proportions of gas and liquid at the beginning and the end of compression.

Ex. 5.—The condenser and refrigerator temperatures being, as before, 80° and 10° respectively, to find what per cent of a mixture must be gas in order that the mixture at the end of compression may have the same percentage of gas.

We might by trial find the position which an adiabatic must have to conform to the condition, but the diagram suggests an easy arithmetical solution. Suppose the adiabatic $s\,s'$ drawn, cutting off from AB_1 $s'A = m$, and from AB_2 $sA = n$. If x be the percentage of gas—

$$x = \frac{m}{AB_1} = \frac{n}{AB_2}$$

$$\frac{n - m}{n} = \frac{AB_2 - AB_1}{AB_1} = \frac{\alpha}{n} = \frac{\alpha}{xAB_2}$$

$$\text{Therefore } x = \frac{AB_1}{AB_2}\left(\frac{\alpha}{AB_2 - AB_1}\right) = \frac{9353}{11688}\left(\frac{.1388}{.2335}\right)$$
$$= 47.57 \text{ per cent.}$$

For the given conditions of temperature if the mixture contains initially a greater percentage than this of gas it will contain finally a smaller percentage. If, on the other hand, it contains initially a less percentage than 47.57 it will finally contain a still less percentage.

Any of the adiabatics $s\,s'$ discussed in the above problems can, of course, be readily transferred to the work diagram by means of the principle referred to at the outset.

We may dismiss the expansion cylinder in a few words, not only because (for reasons which will be apparent) it is not used with ammonia, but because there is really only one problem of interest in the present connection, namely, that in—

Ex. 6.—When liquid ammonia at 80° is allowed to expand in a cylinder till its temperature falls to 10°, what per cent of the liquid is vaporized?

First.—By construction: Through a draw a vertical (adiabatic) cutting AB_2 in s, then $\frac{s\,A}{AB_2}$ is the required per cent of gas.

Second.—By calculation: $s\,A = \alpha$

$$\text{Percentage} = \frac{\alpha}{AB_2} = \frac{.1388}{1.1688} = 11.87$$

The problems of this article are intended to familiarize the reader with the use of the heat diagram. Much

advantage will be derived by solving any of the stock problems of thermodynamics directly from the diagram. The results can easily be compared with the more usual notation by remembering that

$$\alpha = c \log_e \frac{T_1}{T_2}$$

$$AB = \frac{L}{T}$$

$$\beta = \frac{L_2}{T_2} - \frac{L_1}{T_1} - c \log_e \frac{T_1}{T_2}$$

When these substitutions are made, the identity of the results will be apparent.

[*Adapted for* ICE AND REFRIGERATION.]

FREEZING FISH.

HOW FISH ARE FROZEN IN THE CITY OF SANDUSKY, OHIO—KINDS OF FISH BROUGHT TO THAT MARKET—FISHING NOTES.

IN a recent article under the above title, in speaking of A. J. Stoll's plant for freezing fish, the capacity was made by a printer's error to read twenty tons per year, instead of that amount daily. The correction of the error, however, is sufficient excuse for again speaking of the enterprise, which is leased to the Sandusky Fish Co.

The machinery consists of two Pontifex-Hendrick machines of twenty-five tons ice making capacity, only one machine being now in operation, the other held in reserve. The freezing rooms and cold storage are cooled by brine circulation.

"When the fish are unloaded from the boats they are first sorted and graded as to size and quality. These are placed in galvanized iron pans twenty-two inches long, eight inches wide and two and a half inches deep, covered with loosely fitting lids, each pan containing about twelve pounds. The pans are then taken to the freezers. These are solidly built vaults with heavy iron doors, resembling strong rooms, and filled with coils of pipes so arranged as to form shelves. On these shelves the pans are placed, and as one feature of the fixtures is economy of space, not an inch is lost. The pans are kept here for twenty-four hours in a temperature at times as low as 16° below zero. Each vault or chamber has a capacity of two and a half tons, and there are sixteen of them, giving a total capacity of forty tons, which is the amount of fish that can be frozen daily if required.

"On being taken out of the sharp freezers the pans are sent through a bath of cold water, and when the fish are removed they are frozen in a solid cake. These cakes are then taken to the cold storage warehouse, which is divided into chambers built in two stories, almost the same as the sharp freezers. The cakes of fish, as hard as stone, are packed in tiers and remain in good condition ready for sale. It is possible to preserve them for an indefinite time, but as a rule frozen fish are only kept for a season of from six to eight months. They are frozen in the spring and fall when there is a surplus of fish, and sold generally in the winter or in the close season when fresh fish cannot be obtained. The warehouse has a storage capacity of 1,500 tons.

"Though the freezing plant has only been in full operation since the first of August last, about 550 tons of various kinds of fish have been frozen. Some cisco or lake herring from Canada and some sturgeon were frozen last July, and the following varieties were frozen during the fall: pickerel, blue pike, yellow saugers, yellow perch, suckers and mullets, sheepheads, white bass, upper lake and Lake Erie white fish, ocean blue fish and weak fish.

"It is an interesting sight to note the process of freezing. The interiors of the freezers and cold storage chambers are so thickly coated with beautiful snow crystals that it gives them the appearance of an enchanted cave. The fish, though frozen together, keep their shape, are clean and their condition can be seen at a glance.

"The freezers and cold storage warehouse are built of stone, with iron roof and iron doors and concreted attic floor. The place is well ventilated and fireproof, and the entire plant represents an investment of $45,000."

FISHING NOTES.

——W. E. Sawyer has put up an ice house to store ice to supply fishermen at Boothbay Harbor, Me.

——The Erie Fishing Association is building a large ice house at the new headquarters, foot of State street, Erie, Pa. The house will hold 7,000 tons of ice.

——The S. H. Davis Co., Detroit, Mich.; capital stock. $50,000; single share, $10. Catching, curing and dealing in salt and fresh fish. Promoters: Samuel H. Davis, James B. Jessop, W. C. Maybury, all of Detroit, Mich.

——Standard Fish Co., San Diego, Cal., capital stock, $150,000, to catch, cure, can and deal in fish and fish products, has been incorporated by Alexander Parsons, Louisa B. Parsons, Louis Mendelson, Ella R. Gilivan, Zeeb Gilivan.

——Luther Maddocke & Co. have purchased land at Boothbay Harbor, Me., and are hard at work with a crew of men, building a dam to make an ice pond to cut ice for their fish freezing factory and to supply fishermen with ice. They will build an ice house on the shore, where they can pack or freeze fish.

CONSOLIDATIONS AND ASSOCIATIONS.

——The ice companies of Kalamazoo, Mich., have been consolidated, with H. B. Peck as president; E. S. Rose, secretary and treasurer; Fred N. Root, manager; capital, $20,000.

——It is reported that the Naugatuck and Ansonia Ice Co.'s, Bridgeport, Conn., are about to consolidate. They have been practically one for some time, and get their ice from the same ponds. At a recent meeting of the Ansonia company H. D. and E. A. Upson, of the Naugatuck company, were elected directors. The new company will have a capital stock of about $300,000.

——It is reported in Reno, Nev., that the Union and National ice companies have compromised, the National taking 40 per cent of the profits and the Union the balance. "Thus ends what has been the longest and most expensive contest the Union Ice Co. ever experienced," says a Nevada paper. "Three years ago the National was started by S. H. Simonds and one or two of the old Union ice men with outside capital. The enterprise was fought from the first. It is said that both companies have been hostile toward each other so far as to reduce the price of ice to ridiculously low figures, each striving to get all the business, regardless of cost. The Union levied an assessment of $5, so it is reported, while the National threw a number of shares of their reserve on the market."

——All the warehousemen of St. Paul and Minneapolis have formed an association for mutual benefit. There is over $1,000,000 invested in the business there. The following gentlemen were elected as officers of the association: Harry B. Wood, of the Security Warehouse Co., of Minneapolis, president; James Lewis, of Lewis & Anderson, St. Paul, secretary; executive committee: W. H. Patterson, of the Thurston Cold Storage and Warehouse Co., St. Paul, chairman; M. L. Hallowell, Jr., of the Itasca Warehouse Co., Minneapolis, and James Lewis, of Lewis & Anderson, St. Paul. When seen in regard to the matter Mr. Patterson explained the purposes of the association; and when asked whether there was any intention of pooling the interests represented or forming a syndicate, he replied with a prompt and emphatic negative, saying that the financial interests would be kept entirely separate.

THE article on another page on "Boiler Firing and Management" is commended to the attention of employers. It is a timely subject, and has been boldly treated because the cause is traced back to its cause, the employers themselves. "Cheap labor" is always expensive labor, and never more so than right here in the boiler room.

OBITUARY.

SUDDEN DEATH OF GEO. P. ROGERS, PRESIDENT OF THE CONNECTICUT ICE DEALERS' ASSOCIATION—OTHER ITEMS.

ON November 24, Geo. P. Rogers, of New London, Conn., president of the Connecticut Ice Dealers' Association, was found dead in his bed at the Crocker house, New London, having died suddenly in the night, of heart disease. Mr. Rogers had no family, and had made the hotel his home.

Mr. Rogers, who was seventy-three years old, was a native of Connecticut, and a lineal descendant of John Rogers, the dissenter who was burned at the stake in 1555. He was a man of radical opinions, like his great ancestor, having, after voting for Birney, in 1844, become one of the organizers in his state of the republican party, and afterward of the prohibition party. In 1854, with his brother, he organized the firm of Rogers Bros., ice dealers, the first distinctively ice business in that state. The firm became well known all through New England, and the business made them rich.

OTHER DEATHS.

—James Harvey Sherman, at one time in the ice trade, died at New Bedford, Mass., December 13, aged seventy-eight years.

—Richard Armiger, of Baltimore, known in the East after 1875, as a manufacturer of refrigerators, died in that city December 10, aged seventy years.

—Darius Eddy, of Boston, a well known manufacturer of refrigerators, died in that city, December 15, of pneumonia. Mr. Eddy was born in 1802, and amassed a fortune in the building of refrigerators.

—Alfred Haywood died at Savannah, Ga., December 9, at the age of seventy-six years. He had been a resident of Savannah for forty years, during many of which he was at the head of the firm of Haywood, Gage & Co , ice dealers. He leaves a widow and three sons and three daughters.

THE LATE GEORGE P. ROGERS, OF CONNECTICUT.

NEW CORPORATIONS.

THE following are the names of new companies which have during the past month been licensed to incorporate, with amounts of capital stock authorized. Where further information is known of them, notice is made in other departments of ICE AND REFRIGERATION:

NEW ICE COMPANIES.

—Eldorado Ice Palace Co., Weehawken, N. J.; $12,000.

CREAMERIES, ETC.

—Vancouver Creamery Co., Portland, Ore.; $30,000.

—Red Pole Creamery Co., Swanger Station, Cal.; $5,000.

—Rich Prairie Creamery Association, Pierz, Minn.; $3,950.

—Jonesville Creamery Association, Jonesville, Vt.; $2,500.

MISCELLANEOUS COMPANIES.

—Halter Packing Co., Chicago; $100,000.

—Montana Poultry Co., Great Falls; $10,000.

—Seattle Produce Co., Seattle, Wash.; $10,000.

—Standard Fish Co., San Diego, Cal.; $150,000.

—Polar Ice Skating Co., San Francisco; $50,000.

—New England Dressed Meat and Wool Co., Buffalo; $10,000.

OCEAN AIR AND PEACHES.

A TELEGRAM from Wilmington, Del., November 1, contains some information which may be of value to shippers of fruits across the ocean. The telegram says:

"State Treasurer Wilbur H. Burnite recently made an effort to treat Ambassador Thomas F. Bayard to a taste of Delaware peaches in his far-away English home, but the attempt was not entirely successful. The varieties of fruit selected were Fox's seedling, Walker's variegated free, and the prize, and each peach was carefully wrapped in tissue paper. All were packed in carriers containing separate cells, and the carriers were placed in the refrigerator of the steamship City of Paris, which started for Europe within ten hours after the fruit was picked from the trees. The peaches arrived at their destination in due time, but only a small percentage of the shipment was in good order. In a letter to Mr. Burnite Mr. Bayard says that the transportation of peaches across the Atlantic is not yet practicable. He adds:

> This is a great pity, because, if some mode of air tight transportation could be invented, it would lead to a great profit. All peaches here are grown with the greatest care in hothouses, and are luxuries for the rich alone. I do not think I have seen more than six—and generally two or four—peaches at a time on the tables of very rich and titled people. I have paid more for two peaches here than for a basketful at home. One cantaloupe melon costs as much here as a basketful at home. The hothouse peaches are very delicate, thin-skinned and pleasant, but lack the flavor which the Delaware peach bestows. In the progress of time the shipment of our fruits will become practical and will lead to good results, but now it is not practical.

"Notwithstanding this failure to get Mr. Bayard's peaches through in good order, the experiment has impressed peach growers with the possibility of successfully shipping peaches to Europe. The trouble seems to be that the sea air tends to affect the condition of the fruit and hasten its decay, as it is known that the varieties sent to Mr. Bayard can be well preserved here for a longer time than it took to get them to London."

THE publishers call attention to the new department which appears in this issue of ICE AND REFRIGERATION, "The Engine Room." It is our desire that the department will remain a permanent monthly feature of this journal, and every effort in that direction will be made by the publishers; but in order that it may be made permanent and also valuable the editor must have the coöperation of the engineers themselves on lines suggested by Mr. Otto Luhr in his interesting and valuable article this month. Contributions to the departments and suggestions of subjects to be treated will be welcomed. Proprietors are particularly requested to show this issue to employes, and invite their coöperation.

ICE & REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION, THE TEXAS ICE MANUFACTURERS ASSOCIATION AND THE FLORIDA ICE MANUFACTURERS ASSOCIATION.

.·. JANUARY, 1894 .·.

RATES OF SUBSCRIPTION.

IN ADVANCE, POSTAGE PREPAID.

United States, Canada and Mexico, - - - - - $2.00 a Year
All other Countries, - - - - - - - - - 3.00 "

Single copies 25 cents. Advertising rates on application to the offices. Remittances must be made by post-office orders, postal notes, international money orders, checks or drafts on New York, Chicago or London, payable to H. S. Rich & Co.

H. S. RICH — S. P. FOWLER — J. F. NICKERSON — JNO. GLENN COLLINS

H. S. RICH & CO.

PUBLISHERS,

177 La Salle St., Cor. Monroe, CHICAGO. — 206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

*** ICE AND REFRIGERATION, at the World's Columbian Exposition, received a medal and diploma for editorial, typographical and artistic excellence—the highest award given to any trade journal at that Exposition.

*** ICE AND REFRIGERATION is issued promptly on the 1st of each month. The first advertising forms go to press on the 20th, and the last on the 27th or 28th. Changes in advertisements should be sent in before the 20th.

INDEX TO ADVERTISERS.

THE OLD STORY.

THE publishers of ICE AND REFRIGERATION continue to receive the "good words" which "Constant Reader," "Veritas" and other good people continue to send in; and the following are particularly prized because they come from old readers who have seen probably every number of ICE AND REFRIGERATION:

[SANFORD ICE CO., Sanford, Fla.]

We enclose $2 for ICE AND REFRIGERATION. We would not miss having the paper for three times this amount.

[ROME ICE MFG. CO., per Manager, Rome, Ga.]

We can't get along without the journal; there is no such thing as trying to run an ice factory successfully without it.

A SHIP REFRIGERATOR.

THE new steamship Perthshire, built for the Australian and New Zealand dead meat trade, for Messrs. Turnbull, Martin & Co., of London, has just recently started from the Tyne on her first voyage, says the *Steamship*. Her insulated holds and 'tween decks have a total capacity equal to the carrying of nearly 2,500 tons of beef, mutton, fruit and dairy produce, and they are refrigerated by machinery on the Linde system. There are two machines, and one or both may be worked at one time. These machines are each self-contained on one bed plate, which forms the casing of the ammonia condenser. The ammonia compressors are compound, and so are the steam cylinders, which exhaust their steam into an independent surface condenser. The refrigerator consists of series of direct expansion coils in two sets, placed on the deck above the insulated holds. Air is caused to travel over the cold surfaces of these coils by means of fans, and the air thus cooled is then passed into the holds by means of air trunks in the usual way, the comparatively warm air being drawn back to the coils to be again cooled. The refrigerating machinery was thoroughly tested in cooling the holds while the vessel was in the Tyne, and it worked without the slightest hitch. The official test took place on November 12, and in the course of a very few hours the mean temperature of the holds was reduced to about 4° above zero F., only one machine working. On the voyage round to Plymouth a further test was made, when the holds were easily reduced to a mean of a little below zero. The machines are well designed, and very strongly constructed, and their working was much admired. Those conversant with the subject of refrigerating machinery were much interested in the rapid cooling of the holds to such a low temperature, and by the entire absence of brine or ammonia pipes in the holds. The circulated air was perfectly clear and free from moisture, and there was no trace of snow in any part of the ducts. Quite a large number of Linde machines are now in use on board ship, both for the carriage of chilled and frozen meat as well as for fruit and dairy produce, and these machines are supplied both with the air circulation system, as described above, and with the brine pipe system.

ANSWERS TO CORRESPONDENTS.

COOLING THE CONDENSER WATER—ALLEGED EFFECT OF DRY AIR MACHINES—HEATING THE FEED WATER—EFFECT OF COOLING WATER—COLD STORAGE FOR TREES—PIPE LINE REFRIGERATION—SECOND CROP ICE—STORAGE OF GRAPES AND EGGS.

[This department of ICE AND REFRIGERATION is conducted for the benefit of the trade generally, as well as individuals; and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

COOLING THE CONDENSER WATER.

To the Editor: I recently sent on my subscription to your valuable journal, ICE AND REFRIGERATION, and I hope you received same safely. I would very much like to know the proportionate effect of cold or warm condensing water in regard to the effective action of the ammonia in a compression plant.

What I mean particularly is this: Say that I wish to refrigerate 4,000 cubic feet of space, which under ordinary circumstances I could do with machinery we will designate as (1). Now, at certain seasons of the year my condensing water runs up to 90°. If I should put in machinery capable of refrigerating 8,000 cubic feet of space under ordinary conditions and condensing or cooling water at 60° F., which we will designate as (2), could I use this extra refrigerating effect for cooling my condensing water down to 60° before it passed to the condenser?

I would propose to use a brine system, pump my brine through my rooms, 4,000 cubic feet, and in returning let the brine pass through a closed tank (so as not to lose any effect by exposure to the atmosphere), in which will be placed a coil through which the condensing water has to pass on its way to the condenser.

By putting in this machine of greater capacity, could I not utilize the extra capacity to cool the condensing water?

The economy of fuel or the time required to run to keep down my rooms does not make any difference whatever; I simply wish to overcome the trouble of the hot condensing water.

If there is any recent publication on the subject of refrigerating and ice making that you can recommend, please let me know. Hoping for a prompt reply. C. J. K.

ANSWER.—The advantages which you seem to expect from the way in which you propose to cool your condensing water are altogether illusory; for whatever heat is withdrawn from one portion of the cooling water must be withdrawn from your refrigerating system by an extra effort, which can only be done at the expense of a great amount of refrigerating capacity, which in being used directly would be put to much better use. It is a very good idea to try to get cooler condenser water, but it will not pay to obtain it by means of artificial refrigeration, when the object of the cooling water is to produce, or to help produce, just such refrigeration. There are other means to obtain that end, which are available in many localities, and which consist in passing the water over graduating works, such as are used for the concentration of salt brine. The water in passing over these works, exposed to a draft of air, is cooled by evaporation, and in this way you may be able to attain your object in a rational manner. For good reading on refrigeration we can recommend you the back numbers of ICE AND REFRIGERATION; these also contain the titles of all other publications on this subject under the head of "New Books."

ALLEGED EFFECT OF DRY AIR MACHINES.

To the Editor: Will you kindly answer through ICE AND REFRIGERATION the following:

What is the shortest time possible to freeze thoroughly to the bone quarters of beef (also sheep) from the time of killing; atmosphere at 70° F.?

1st. By the cold dry air machines.

2d. By ammonia compression machines.

3d. By ammonia absorption machines.

4th. By carbonic acid machines.

I have not seen this answered in any previous number. Please answer under.

Is it true that the chemical machines are so long in freezing the meat to the bone that what is known as bone taint sets in, which does not occur with the dry air machines on account of the very low temperature that can be obtained with them, and consequently freeze more rapidly? I know that this is at the expense of coal consumption. A. J. T.

ANSWER.—There is no difference in the temperature that can be reached by either one of the four kinds of machines you mention, and an ammonia or carbonic acid machine may be made to furnish just as low temperatures as the cold dry air machine. On this head, therefore, there is no reason to find a difference between these machines as to the time it would take to freeze a quarter of beef with either of them, which, of course, would depend on the temperature of the room in which the beef is kept. If any superior merit is claimed for the cold dry air machine, it can hardly be on the ground that it is able to produce a greater degree of cold, for this is not the case; but it might be argued that the cold air entering the refrigerating room and circulating in the same freely (ventilating the room, as it were) would renew more quickly the refrigerating surface coming in contact with the beef or other material, and therefore cause a more speedy freezing than could be accomplished by radiation alone. However, as you yourself intimate in your letter, this extra effect would have to be bought at an extra expense for fuel or refrigerating capacity, generally speaking. In a similar way it might, perhaps, be argued that the beef would keep better in a room refrigerated by direct cold air on account of the dryness of the latter, which also tends to keep the refrigerating room dry.

HEATING THE FEED WATER.

To the Editor: I am trying to devise some method of reducing consumption of fuel. We use a common boiler feed pump for taking water from tank and forcing it into boiler.

What would be the effect of laying pipe through back of furnace, so that water would pass through it in its passage from pump to boiler? I am aware of the fact that it would be necessary to keep water passing through this pipe at all times. I can arrange for that, but in doing so am confronted with another problem. The water driven by pump to boiler would be about 150° F. when it enters pipe in furnace, but when pump is stopped and water from another source forced through the pipe to keep it from burning out, its temperature at the time of entrance would be 70° to 80° F. Would this sudden change from hot to cold water cause an explosion in the pipe? If an explosion should take place in the pipe, would there be danger of its extending to the boiler? It has been my intention to have about twelve lineal feet of 1¼-inch pipe exposed to heat of furnace. Would you use more or less in making the experiment?

Please give me your views upon this subject. J. T. G.

ANSWER.—There need be no apprehension as to the possibility of an explosion on account of the change of water from 70° to 150°, neither in the pipe nor in the boiler. At any rate, we cannot see how any danger or accident could be caused by the condition mentioned. As to the proper length of the pipe to be used, it depends on several circumstances, as on the amount of water to be passed through it in a given time, and on the available space in the back of the furnace. We judge that you cannot take the pipe much longer than twelve feet without unduly impairing the draft of your furnace, and this point you must hold in view. On the other hand, a longer pipe would be of greater efficiency.

EFFECT OF COOLING WATER.

To the Editor: Will you please give me the correct formula for determining the amount of water necessary for ice making

at different temperatures? Say it requires seventy gallons at 70°, how many gallons at 80° will do the same work?

The form of condenser is atmospheric, gas entering top of can, water leaving can at 100° in both instances. Is the following the proper plan: 100—70=30, 30×70=2100=B. T. U. extracted; 100—80=20, 2100÷20=105=number of gallons required at 80°?

P. R.

ANSWER.—Your mode of calculating and result, viz., "105 gallons," is quite correct. The initials B. T. U. are not properly used by you, however; still, that does not interfere with the correctness of your calculation. B. T. U., which stands for "British Thermal Unit," represents the amount of heat transferred in elevating or lowering the temperature of one pound of water for one degree, and not of one gallon, as you would seem to have it.

COLD STORAGE FOR TREES.

To the Editor: What is the object of cold storage for young trees? Is it to keep them better over winter, or is it for some other purpose? Please let us know when they should be put into storage to accomplish this purpose.

H. V. L.

ANSWER.—The object for placing young trees in cold storage is not to keep them better over winter, but simply to hold back premature and irregular growth during a time in which there would be danger that the growth once started will not go directly along without interruption. Thus if a young tree is planted out in winter or early spring, and a transient spell of warm weather sets in, there are likely to be repeated but abortive efforts to grow which will exhaust the vitality of the tree before the proper growing season has arrived. This can be prevented by placing the young trees in cold storage during the period within which they would be so exposed to premature growth. This period will vary somewhat in different localities, but can be readily determined after what has been said above. It should embrace such times as are likely to have warm growing weather changing off with bud-killing frosts.

PIPE LINE REFRIGERATION.

To the Editor: Have you any information regarding the operation of so-called pipe line companies, who furnish artificial refrigeration direct by means of pipes carrying compressed ammonia or air, and doing away with ice entirely? How do these companies sell their commodity—by meter, or how? Do their prices depend on the price of ice?

D. SP.

ANSWER.—As far as we know, these companies are working with good success, more especially the St. Louis Automatic Refrigerating Co., at St. Louis, and Colorado Automatic Refrigerating Co., Denver; and similar plants are about to be started in Kansas City, Mo., and in Boston. The cold, as we understand it, is not sold by meter as yet, but special contracts are made to cool a given ice box, a given room, or to supply so many taps with ice water, etc. In making such contracts it appears that the price of ice then ruling does not cut much of a figure, the convenience of the system being so greatly in its favor that the available consumers consider this foremost, as is also the case with gas light and electric light when it comes in competition with kerosene oil or other antiquated modes of illumination. For more explicit information on this subject you would perhaps do well to address Mr. John E. Starr, secretary of the St. Louis Automatic Refrigerating Co., of St. Louis, Mo.

SECOND CROP ICE.

To the Editor: We have learned that there is considerable objection to a season's second crop of ice. It is stated that, although the same may have the required thickness and may present to the eye all the cleanness, clearness and solidity to be desired, it will nevertheless be brittle and difficult to cut and become slushy and unclean after marketing, and fail by several hours to last as long as first crop ice. Are these objections well founded in your opinion, or are they due to prejudice?

TH. H.

ANSWER.—While there are probably some tangible facts at the bottom of the objections as stated against second crop ice, we think the broad generalization of them is not justified by experience. There are evidently many causes which are apt to coöperate in the formation of second crop ice tending to make it bad, and doubtless frequently do so make it. But in these cases we imagine that the defects are more or less readily noticed, and besides being bad the ice will look bad, too. But if second crop ice is formed under equally favorable conditions as the first crop, under the influence of a severe cold spell of sufficient duration, there is no doubt why such ice should not keep well and look well, too.

STORAGE OF GRAPES AND EGGS.

To the Editor: Please advise me through the columns of your valuable paper of any known substance to remove dampness from refrigerator rooms. We have put grapes in storage and have held them at the right temperature, still they are inclined to mold. And is it necessary to have ventilation for rooms in which eggs are stored?

D. M. T.

ANSWER.—Chloride of calcium is about as good a dryer for rooms as we know of; in fact, there is scarcely another that is as cheap and equally effective. In the correspondence column of the last issue of ICE AND REFRIGERATION, page 331, we have also occasion to touch upon this subject, and we have explained at that place how the spent chloride of calcium can be revived for repeated use. Drying and ventilating the rooms will doubtless assist in keeping the grapes from getting moldy, but perhaps a little colder storage would be equally beneficial in this respect. We think that rooms in which eggs are stored should also be well ventilated.

SUBIRINE.

IT is said that considerable use is now being made of the newly introduced French article to which the name of "subirine" has been given. The substance consists of pulverized cork of different degrees of fineness, known as impalpable, fine, medium and coarse, the pulverization being effected by very simple means, such as a horizontal grindstone. Among these the medium powders have for some time been employed in the French navy and by various navigation companies for painting the sheet iron and partitions of the insides of vessels; the effect of such coatings is said to be to considerably diminish the conductibility of the sheet iron, and the vibrations so unpleasant, which are produced as soon as the sea becomes a little rough. Another use for these cork powders is in the preparation of a substance called liégine, which consists of the powder mixed with fine plaster in the proportion of about 10 per cent. This liégine composition is turned out in all shapes and sizes, and is stated to be specially useful as a protection alike from heat or cold, or for partitions, roofs, lofts, ceilings and coatings of all descriptions; also as packing for boilers, ice houses, conservatories, coverings for wagons, steam pipes and similar uses—in short, for the large number of cases where it is desirable to maintain an equal temperature.

[*Written for* ICE AND REFRIGERATION.]

LEGAL MATTERS.

THE RIGHT TO TAKE ICE FROM NAVIGABLE STREAMS—THE LAW NOT SETTLED IN ALL STATES—THE GENERAL RULE—MINOR LEGAL NOTES.

IT is only within a comparatively few years that ice has obtained the great importance which it now has as merchantable commodity. As a consequence, the law concerning the many points as to which questions must arise with regard to it, analogous to which are the adjudications touching no other article, is but being formed. For years to come the decisions with regard to ice will be of much more importance in settling public rights than in merely determining the private controversies between the parties litigating. Legislation may need to be enacted, and laws must, in all probability, be passed in many of the states before the most fundamental questions are satisfactorily settled to the public interests throughout the country.

The general rule in this country at the present time seems to be that the title to ice on navigable waters is the same as the title to the land under the water. In other words, the title to ice formed on navigable waters is the same as the title to the soil underneath them gives individuals to the water at the same place. Of course, this title is subject to the public rights in such navigable waters. Still, it would seem that it would not be any justification to an unlawful taking of ice from a navigable stream; that it would be an aid to the navigation thereof.

The title to the soil under navigable streams is held to be differently vested in different states. This, of course, under the rule stated, makes the title to ice formed on such waters very different in some of the states from what it is in others. Thus, in Iowa, Kansas, Missouri, North Carolina and Pennsylvania, and perhaps some of the other states, it has been held that the soil under navigable streams belongs to the state, and that all persons have equal rights in the ice formed thereon.

It is plain, says the Supreme court of Iowa, in *Brown* v. *Cunningham*, 12 L. R. A., 583, that the same rights to the ice exist which may be held to the water, for the ice is water in another form. Its uses for comfort, luxury and health are known and demanded everywhere. It cannot be doubted that any citizen who may lawfully go upon the stream may gather ice from it under the regulations prescribed by law. He is entitled to the ice he prepares by his labor to be removed. When men are thrown together without government or established rules to regulate their possessions and use of the land they occupy, they tacitly assent to just such rules as follow from this doctrine. This has been done by settlers and miners in every territory of the Union, as well as in every land where the ideas of civilized justice, and especially of the Anglo-Saxon ideas of the protection of individual property, prevail. Shall not the courts, where there is established government, recognize, protect and enforce rights which are instinctively recognized by our people?

Individual ownership of the ice formed on navigable rivers is expressly denied by the Court of Appeals of Missouri in *Hickey* v. *Hazard*, 3 Mo. App., 480, to those who own the land adjoining such rivers. The right to claim portions of this ice and give it a commercial value derived almost wholly from the labor bestowed upon it, this court holds, is a right which may be assimilated to the right of reclaiming animals wild by nature. These can only be reclaimed by actual possession. The surface of the river is free to all; and in the water itself, whether in its running state or congealed, there can be no property except that derived from possession. The ice is not permanently attached to the soil, though the edges of a mass may rest upon it. It does not even depend directly upon the soil for support. Cutting ice on a navigable stream in such a way as not to interfere with the use of its waters for commerce or navigation, or any use to which the stream may be put by the general public, is not a trespass. It is not to be likened to cutting down trees or cutting ice on a pond on public or private property.

The doctrine of these states would also seem to be that when a person makes preparations to use the ice upon a certain part of the stream, prepares its surface for cutting, erects machinery to handle the ice, makes walks or ways for workmen, or in any other proper manner indicates the part of the stream which he occupies in his operations, which must be reasonable in extent and in all other respects, he has a property right to the occupation of such locality during the ice season and to the ice formed there. It is even plainer, if possible, that if he cuts ice for transportation to his ice house another cannot rob him of his labors by carrying away his ice.

In all, or almost all, of the other states than the five named above the English common law, which did not know the difference between a navigable stream and one where the tide ebbed and flowed, which has practically been rejected in this country, where there are many navigable streams in which no tide is perceptible, so far as it, in other respects, concerns such waters, is still applied to the extent of giving the owners on the banks of navigable rivers, where there is no ebb or flow of tide, the ownership of the subjacent soil to the thread of the stream. This gives riparian owners, or those persons who own the land adjacent to such rivers, all rights in same not opposed by the public right of navigation, nor by the rights of upper and lower proprietors. These rights are held to include the unlimited use and appropriation of such ice as forms upon the streams over the subjacent soil owned by them. When the water becomes congealed, and is in that state, the opposite rights of the public and upper and lower proprietors are said to be in no wise concerned.

Maine and Massachusetts present exceptions, in that they hold that the right to cut ice upon great ponds is a public one, free to all. In this particular the right of a riparian owner is no greater than that of any other person who can reach a pond without becoming a trespasser upon the lands of others. Ten acres or more will for this purpose constitute a great pond. The right of fishing and the right of taking ice are there regarded as the same. But while the right of taking ice on such ponds is common to all, no one, it is held, has the right, to the exclusion of other public uses, to the occupation of any part of the pond for the purpose by artificial means of increasing the thickness of the ice.

Where the public has the right to harvest ice it will also usually be found to have the right of traveling upon same. The question then naturally arises as to whether those members of the public who want to cut ice, or those who want to travel upon it, shall be allowed to do that which they desire. Each right is, in theory, speaking generally, the Supreme court of Maine holds, in *Woodman* v. *Pitman*, 79 Me., 456, relative or comparative. Each recognizes other rights that may come in its way. Each must be exercised reasonably. And what would be a reasonable exercise of the one or the other at any particular place—for clearly there would be a difference in the relative importance and of the different rights in different localities—depends in a large degree upon the benefits which the community derive therefrom. The public wants and necessities are to be considered. The two kinds of franchises belong to the people at large, are owned in common, and the good of all must have a decisive weight on the question of individual enjoyment. The right of travel on ice of navigable rivers in all places is generally inferior to the right of navigation. In the earlier days the natural ways were the only ways for travel, and upon the large ponds and lakes and upon the rivers in remote places the same necessity may even now exist. But the importance to the public of the ice privileges within many districts is now incomparably greater than is that of traveling on the ice. The business of gathering ice for merchantable purposes has assumed extraordinary importance on many of our rivers. It would seem unreasonable to embarrass such an important enterprise, furnishing employment for thousands of men and teams, by according to the traveling public a paramount right of passage, when such right, even to its possessor, is scarcely good for anything. The idea of roads over the frozen surface of rivers was never broached in the old common law—it has grown up since—and should be the superior right or not, according to circumstances.

MINOR LEGAL NOTES.

——B. L. Duke, Raleigh, N. C., interested in many industries, including an ice factory at Durham, made an assignment December 13; assets, $600,000; liabilities, $500,000.

——The Schuehle Ice Manufacturing Co.'s plant, San Antonio, Tex., was sold by W. G. M. Samuel, the deputy sheriff, December 4 to satisfy a judgment of $2,500 recovered by D. T. Pardue *et al.* The plant was purchased by the plaintiffs in the case in consideration of their claim.

——The Crowell & Class Cold Storage Co., Philadelphia, made an assignment December 12, naming the Equitable Trust Co. as the assignee. A bill in equity was filed asking for the appointment of a receiver to wind up the affairs of the company. Judgments to the amount of about $35,000 have been entered against them. Generally the liabilities are stated at about $60,000. Messrs. H. P. Crowell and Chas. Class, founders of the business, had no interest in it at the time of the failure, the stock of the company being owned by D. K. Joslin and others.

——In the matter of *D. M. Smith* v. *R. & W. Scott*, operating as the Standard Ice Co., Kingston, N. Y., the jury gave the plaintiff a verdict of $350. Smith, who was in defendant's employ, on January 28 had his foot injured by a cake of ice crashing against it while he was going up the runway to make some repairs. The ice was being switched from this runway to another one, and the ice which struck plaintiff passed through the open switch. This he alleged was due to the fact that the switch was defective. Defendant claimed that the switch was of the most approved pattern and was in good working order.

——On December 18 John A. McKelvey, an ex-saloon-keeper, of Pittsburgh, Pa., entered suit for $20,000 damages against the Chautauqua Lake Ice Co. and the Crystal Lake Ice Co. He got into a dispute with the Chautauqua company last September about an ice bill, which he claimed was excessive and which he would not pay. He says the ice men boycotted him and he could get no ice. His liquors were not cool and his patrons deserted him. He was sued for the ice bill and his credit broken by false reports. His creditors issued executions against him and the sheriff closed his saloon. Now he is without an occupation and wants compensation for the injuries he has sustained.

ICY ITEMS.

——C. C. Robbins is building an ice house at Bristol, Me.

——The Norwood Ice Co. (R. I.) are building a new ice house.

——Jos. Covell is building an ice house at Dodgeville, N. Y.

——Frank Drahos is building an ice house at West Point, Neb.

——Wm. Dongler is building an ice house at Birdsboro, near Reading, Pa.

——The McCollum Ice Co., Lockport, N. Y., is building a 3,000-ton ice house.

——Frank Kaye, Aberdeen, Mass., is looking for a good location for an ice factory.

——P. M. Sauvignet has purchased the ice factory at Laredo, Texas, of W. W. Wight.

——The Colorado Automatic Refrigerating Co., Denver, has increased its capital stock to $350,000.

——An effort is being made to get the Corryville Artificial Ice Co., Cincinnati, on its feet again.

——The Arctic Ice Co., Newport, R. I., has paid a 6 per cent dividend on last year's business.

——James McIntyre has purchased the business of the Middlesex Ice Co., at Melrose, Mass.

——The Beaumont (Tex.) Ice, Light and Refrigerating Co. declared a dividend of 10 per cent on last year's business.

——The cold storage company at Connellsville, Pa., have fitted up a room with steam coils to be used for ripening bananas.

——The firm of Greene & Reatz, ice dealers at Lawrence, Kas., has been dissolved, E. E. Greene continuing the business.

——E. J. Hetherington has purchased a half interest in the City Ice Co., Hastings, Minn., operated by Hanson & Hetherington.

——E. L. Leitzman, bookkeeper of the Geyser Ice Co., Waco., Tex., is reported a defaulter to the amount of $500. He has absconded.

——The Hopatcong Ice Co. has filed articles of incorporation in Hudson county, N. Y. The company begins business with a capital of $100,000.

——The Metropolitan Ice Co., Chicago, has been licensed to incorporate; capital, $100,000; incorporators, John C. Griffin, John J. McMullin, Chas. W. Hawley.

——The firm of J. P. Mulholland, ice dealers, Council Bluffs, Iowa, was dissolved December 1, J. P. Mulholland retiring and A. B. Nicholas continuing the business.

——The Colorado Automatic Refrigerating Co. has elected C. S. Morey president, A. H. Fowler vice-president, H. R. Wolcott treasurer, J. R. Hazenalbach secretary.

——At the annual meeting of the Rockport (Me.) Ice Co. the following officers were re-elected: President, E. A. Morrill; secretary, W. A. Merriam; treasurer, T. E. Brastow.

——The Eldorado Ice Palace Co., New York, has filed articles of incorporation in Hudson county. The company will utilize part of the Eldorado amusement grounds for the manufacture of ice.

——The Marion (Ohio) Ice and Cold Storage Co., one year old, is well satisfied with the first year's work. The officers of last year were re-elected December 12, F. S. Keiler remaining manager, as last year.

——The C. M. White Ice Co., Woodstock, Vt., recently elected officers as follows: President, Wm. E. Johnson; secretary and treasurer, A. L. Wood; directors, B. F. Standish, O. E. Taylor, C. M. White.

——Montana Poultry Co., Great Falls, Mont.; capital stock, $10,000; to raise and deal in poultry, produce, fruit and vegetables, market gardening, has been incorporated by Jesse H. Russell, Henry L. Russell, T. C. Pigott, of Great Falls, Mont.

——The Eddy Ice Co. has been incorporated by J. H. Waugh, Charles B. Eddy and W. A. Hawkins, of Eddy; capital stock, $50,000; principal office at Eddy, N. Mex. In addition to the above named John Satterfield, of Buffalo, N. Y., is one of the directors.

——All the ice houses, elevator, runs and other property belonging to the Addison Gage Ice Co., at Wenham Lake, Mass., have been purchased by the Boston Ice Co., which company will remove the elevator, engine and the tools to Sharon Heights, and erect them on their property at that place.

——The Nashville Ice Factory, which began operations in 1891, was sold December 13 as per official notice. The bondholders purchased the property for $6,600, subject to a mortgage of $25,000, which they assume. The purchasers are all stockholders, but there are other stockholders who are not included in the list of purchasers. In 1889, 1890 and 1891 the concern cleared about $42,000, or an average of 12 per cent on its capital stock. Considerable of this sum went into improvements, however. In 1892 and 1893, owing to rate cutting, the factory did not do so well, and the stockholders resolved to go into liquidation; hence the sale in December. The factory is still in operation, and it is presumed will be continued without any change in the management. It is claimed that at the sale in December enough over and above the mortgage was realized to settle all outstanding debts.

THE general dullness in business of the times has, of course, had its effect on building. Nevertheless, there seems to be a fairly good feeling, and the record below shows some new work going on. The record includes both ice factory and cold storage plants.

CALIFORNIA.

Needles.—Work has begun on the erection of a 30-ton ice factory.

CANADA.

London.—John W. Wood, of Ingersoll, writes the city council stating his intention of erecting a $7,000 cold storage building on the C. P. road, in this city, to hold 25,000 boxes of cheese, and to accommodate shippers of fruit, butter and eggs and other perishable goods. In return he asked for exemption from taxation for the legal limit of ten years. The solicitor said that as it was not a manufacturing establishment legislation would have to be obtained to grant the request. Such legislation will be applied for, and the prayer of the petition granted.

Montreal.—The Dominion Ice Co., of Montreal, Canada, has been incorporated with a capital stock of $75,000 by the Hon. Henry Starnes, the Hon. Horace Archambault, Henri B. Rainville, Joseph Bernier and Gustave Des Trois Maisons. The object is to manufacture, house and sell ice.

CONNECTICUT.

Ridgefield.—Leonard L. Beckwith will establish an ice factory.

FLORIDA.

Carrabelle.—Pensacola parties have been prospecting here with a view to building an ice factory and engaging in the fish business, upon the completion of the railroad to this point.

Jacksonville.—Carter, Hassel & Co., dealers in butter and eggs, are building a cold storage house.

Key West.—John R. Scott, of the Pure Ice Co., is in Tampa superintending the placing of refrigerators in the Mascotte and Olivette, on the completion of which work the Acme Beer Co. and Armour & Co. will open agencies at Key West.

Tallahassee.—Mr. R. Gamble's ice factory is rapidly approaching completion. Mr. Gamble resigns from the J., T. & K. W. R. R. to operate this plant, which will be a 10-ton plant, the machinery being furnished by the Columbus Iron Works. It will be in operation about February 1.

Waldo.—The ice factory is undergoing a thorough repair, and has been enlarged to meet the call for ice from the fruit and fish trade.

GEORGIA.

Augusta.—At a recent meeting of stockholders of the Augusta Ice Co. it was decided to issue $10,000 in bonds, applying the money realized on improvements adding a 22-ton machine to the plant, which will double the present capacity.

Madison.—The Madison Ice Co. will be reorganized in the near future, and its plant will be overhauled and made ready for operations next season. Additional machinery will be added if needed. Jos. T. Eichberg and M. Benjamin, of Atlanta, are the principal stockholders.

ILLINOIS.

Chicago.—A. H. Barber, dealer in butter, eggs, etc., is about to enlarge his cold storage plant, now one of the best private plants in the city.

Pontiac.—The Illinois State Reform School trustees have purchased for that institution a 2-ton ice making and refrigerating machine from Westinghouse, Church, Kerr & Co., of Boston. The machine will cool a storage room for provision supplies, and also the water served the various drinking fountains in the buildings of the institution.

INDIANA.

Frankfort.—The stockholders in the Frankfort Artificial Ice Co. met December 15 and elected Dr. N. C. Davis president, and W. G. Morris secretary. The capital stock will be $25,000. A 20-ton machine will be purchased.

IOWA.

Des Moines.—Work has begun on the rebuilding of the Lehman cold storage plant.

LOUISIANA.

Plaquemine.—An 8-ton absorption ice factory will be erected, it is reported, and is expected to be in operation by February 15. Machinery has been purchased.

Shreveport.—The Shreveport Ice and Refrigerating Co., the only ice making or refrigerating plant in this city, is adding a bottling works to that plant.

St. Mary.—Dr. Gates contemplates adding a cold storage plant to his ice factory.

Thibideaux.—The Thibideaux Ice Co. is changing the plant from absorption to compression system, the work being done by the Remington Machine Co.

MARYLAND.

Baltimore.—David Eichner is doubling the capacity of the refrigerating machinery of his cold storage house, the additions to the plant being put in by the Remington Machine Co., from whom he purchased the original outfit three years ago.

Hagerstown.—William Dunn & Bro. have erected a cold storage house.

MASSACHUSETTS.

Dorchester.—Work on the buildings and wells for the new ice factory is going on rapidly.

MICHIGAN.

Kalamazoo.—An addition is being built to the cold storage building here to make more room for the business offered.

MISSOURI.

Hannibal.—The ice plant heretofore located at Nevada has been removed to this city.

NEBRASKA.

Omaha.—J. H. Wilson, of Denver, has been in the city talking with members of the Commercial club about starting a plant here for the manufacture of ice and for cold storage.

NEW JERSEY.

Jersey City.—The Enterprise Cold Storage Co., Jersey City, N. J., has been incorporated; capital stock, $20,000. The purpose is to carry on and conduct the business of cold storage, refrigeration, etc.

NORTH CAROLINA.

Charlotte.—The Palmetto Ice Co., of Columbia, S. C., are building a factory in this city. The machinery is the latest model from the Arctic Machine Mfg. Co., Cleveland, Ohio; capacity twenty-five tons. The buildings are completed, and all machinery, etc., have been contracted for, the plant to be in operation on or shortly after March 1. Mr. A. J. Hagood is treasurer and manager.

Raleigh.—The Hygeia ice factory, recently burned, will be rebuilt.

OHIO.

Portsmouth.—J. I. Marsh will put up a cold storage house here, on a lot 56×109 feet, the building to be 22×45 feet, twenty-eight feet high. The refrigerating machinery will be operated by electric motor, power furnished by the local electric company.

OKLAHOMA TERRITORY.

North End.—The Anheuser-Busch Brewing Association has purchased five acres of ground on which the artesian spring is located, and has guaranteed in the deed to put up a cold storage and ice manufactory within ninety days from November. The city will be the distributing point for goods throughout the territory.

PENNSYLVANIA.

Chester.—The Consumers' Ice Co. will enlarge their plant and have made a contract with Kreiss & Stupp, Reading, for the erection of a 30-ton Consolidated ice making machine, built by John Featherstone's Sons, Chicago.

Philadelphia.—The Consolidated Manufacturing Co.'s plant, at Bodine and York streets, will be doubled. During the season of 1893 the company bought nearly 5,000 tons of ice to supply its customers, but with the proposed addition will be able to meet all demands. The building, now two stories high, will have an additional story, giving an added floor space 60×100 feet, which will be devoted entirely to a new ice tank.

SOUTH DAKOTA.

Mitchell.—F. Widman is building a cold storage house at the C., M. & St. P. R. R. tracks.

TENNESSEE.

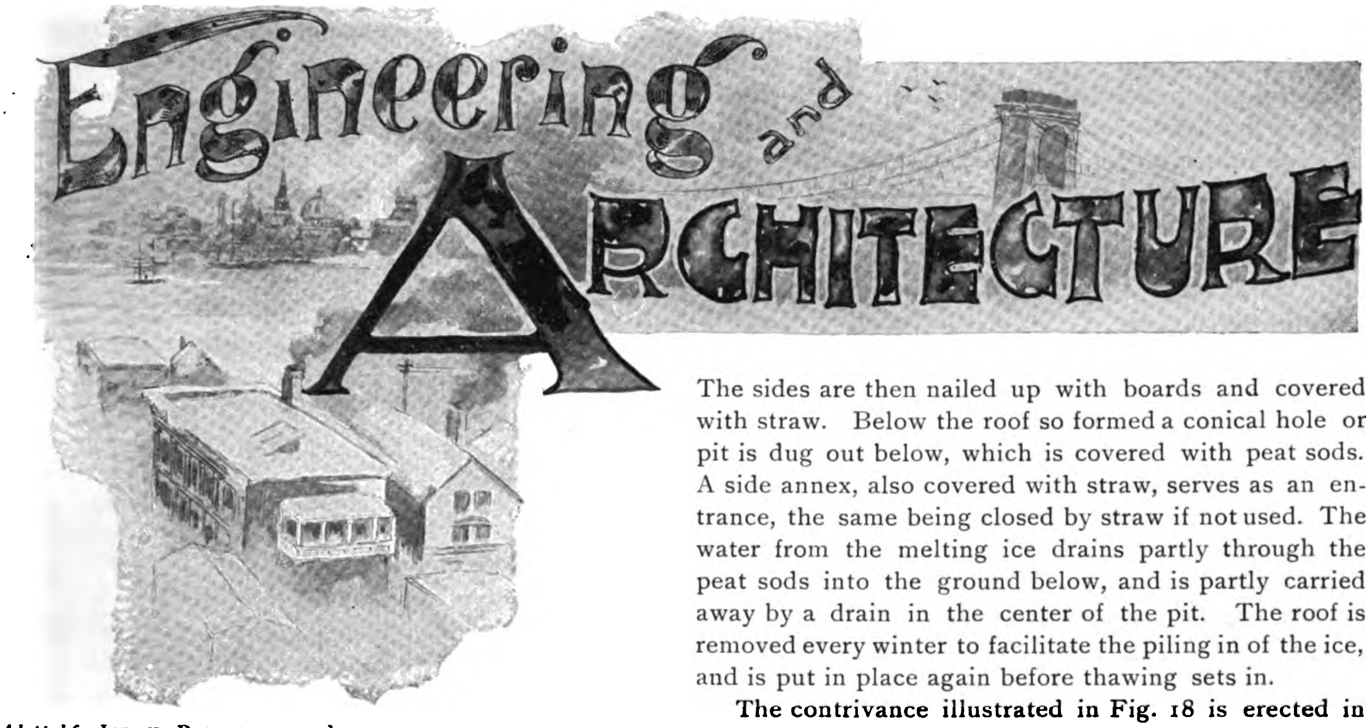
Murfreesboro.—The ice factory was finished November 27, and is now ready to begin operations. It is situated near the water works, and is supplied by a cold underground stream of water, clear as crystal.

UTAH.

Salt Lake City.—The Salt Lake Ice Co. was incorporated December 16; capital, $50,000, 500 shares, of which J. A. Earls holds 496 shares, and the other incorporators, George Nye, E. O. Gates, J. G. Sutherland and B. E. Knox, one share each. The officers are J. A. Earls, president, and B. E. Knox, secretary and treasurer. The object of the company is to manufacture and sell artificial ice.

VIRGINIA.

Norfolk.—The erection of an ice factory of 10 to 20-tons capacity is contemplated. Messrs. Tebault & Co. can give information.



[*Adapted for* ICE AND REFRIGERATION.]

ICE CELLARS AND ICE HOUSES.

JUNG'S DESIGN FOR A SMALL ICE HOUSE—PRIMITIVE ICE HOUSES AND ICE STACKS—UNDERGROUND ICE HOUSES—ICE HOUSE AND PAVILION COMBINED.

(*Continued from December issue, page 389.*)

THE ice house illustrated in Figs. 15 and 16 was designed by Mr. Jung for the *Zeitschrift fuer Bauhandwerker*, and is a little more elaborate than some of the foregoing ones. It is constructed to hold some 1,000 cubic feet of ice. Floor, siding and ceiling are made in double walls, filled out with cinders and sawdust. The ante-room forming the entrance, etc., is built in the same manner, and some available space on each side of the entrance and of the stairway and overhead permits the storage of eatables and other perishable goods. The ice is stored and withdrawn from above, as shown in the vertical section, Fig. 15. The lifting of the door above the body of ice is facilitated by means of a weight and pulley. The roof is covered with straw to keep out the heat of the sun. It is recommended by the de-

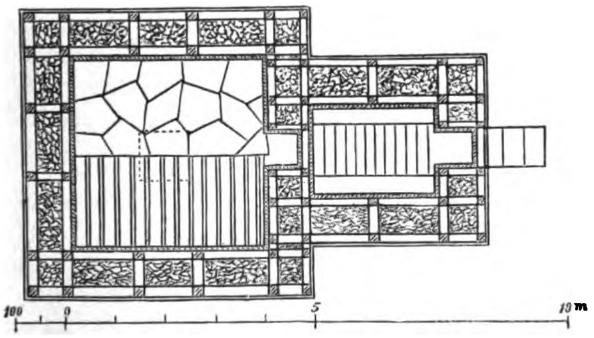


FIG. 16.

signer to chop the ice in small pieces and pack the same in the ice in weather cold enough to enable the whole to freeze together in one solid mass by the aid of water which is to be poured over the layers of ice.

Some very plain and cheap plants for storing ice overground are illustrated in Figs. 17 to 21. The ice stack represented in Fig. 17 is the plainest of all, and consequently the cheapest. Poles are driven in the ground and nailed against a stick in the center, thus forming a frame similar to the ropes stretched for a tent. The sides are then nailed up with boards and covered with straw. Below the roof so formed a conical hole or pit is dug out below, which is covered with peat sods. A side annex, also covered with straw, serves as an entrance, the same being closed by straw if not used. The water from the melting ice drains partly through the peat sods into the ground below, and is partly carried away by a drain in the center of the pit. The roof is removed every winter to facilitate the piling in of the ice, and is put in place again before thawing sets in.

The contrivance illustrated in Fig. 18 is erected in the following manner: Over a shallow depression or pit in the ground boards are placed, and on these a layer of straw about fourteen inches thick. On this floor the ice is piled up as close as possible around a pole driven into the ground previously. This is surrounded on the top and sides with a layer of straw, which is further protected by a regular stack made of straw also. Around

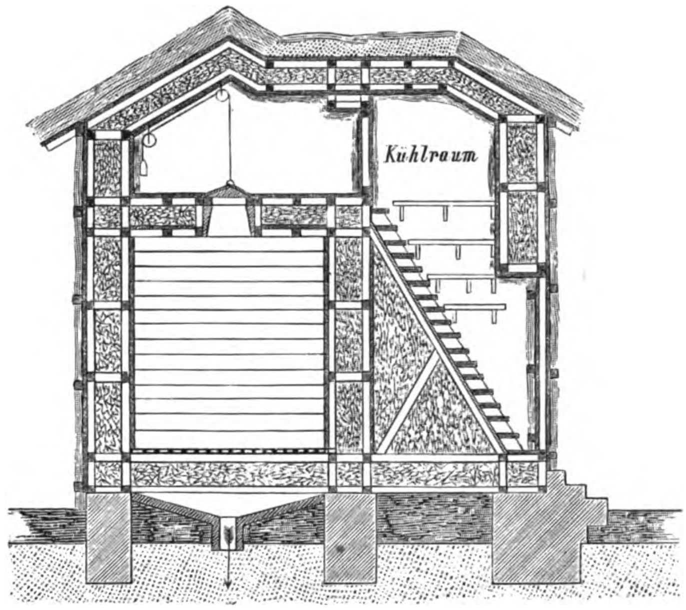


FIG. 15.

this stack a small ditch is dug, and a small side entrance is formed by means of poles driven in the ground and covered with boards. This entrance is closed by means of straw, which is removed and replaced every time when ice is withdrawn from the pile. The whole arrangement must be perfected in cold, frosty weather, and it provides for the requirements of a family during the summer. If it is desired to store goods of any kind in an ice house of this class, it is only necessary to place a wooden chest, box or cask within, and to pile the ice up around and over the same. Access can be effected in the manner already indicated. The straw, however, has one disagreeable property; it decomposes and molds in damp places, whereby the ice acquires a moldy taste,

which renders it unfit for uses in which it is to be brought in direct contact with drinks and eatables. For this reason it is preferable to use peat in place of straw, where the former can be conveniently procured.

Fig. 19 shows an ice stack built with the aid of peat. In order to erect a stack of this kind a strong box framed from oak wood is placed on a rough ground wall made of rubble stones or brick, within which a depression or pit is provided for, to allow the water from the melting ice to drain off. The ice is stored as usual, and the whole surrounded with a thick wall of peat, the exterior of which is covered with straw, with sods or a layer of loam mixed with chopped straw.

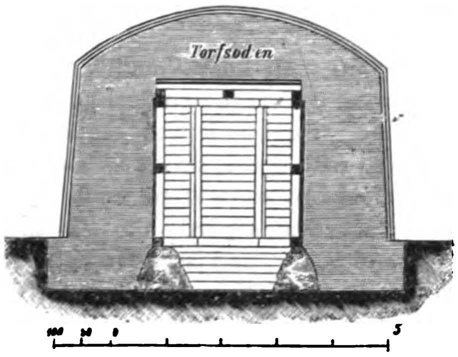


FIG. 19.

The latter covering is frequently painted with coal tar, but in this case the latter should be dusted over with chalk or sawdust so as to obtain a light colored surface, which is less susceptible to the rays of the sun. If peat cannot be conveniently obtained, earth is often used instead, and protected by a plantation of shrubs, etc. In this case the arrangement is, of course, calculated to last for years, and an opening in the top, which can be effectually closed, must be provided for, through which the ice can be brought in in winter. Figs. 19 and 20 show an arrangement which is in use on the farm of Mr. Wigriffe, in Rehorn, Oldenburg, Germany, and which has given excellent satisfaction. On a circular foundation of oak scantlings are placed which are connected by cross-pieces at the top.

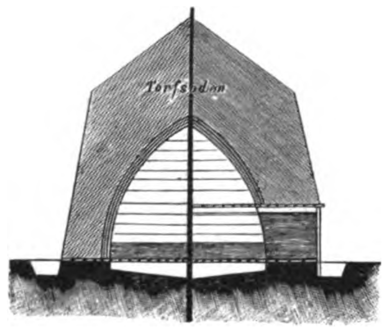


FIG. 18.

On the tent frame so formed strips are nailed, and on these tiles are fastened in the usual roofer's style. The entrance is effected through a small passage from the north side. In constructing this ice stack a pit was dug out first about four feet deep in the center, which point is connected with a drain pipe to carry off the melting water. The floor is made from peat sods laid edgewise and close together. The sods are ten to twelve inches long and about four inches thick. The interstices are filled with loose peat. The sods must be placed as near vertically as possible to the base. Now he oak foundation is put in place and the scantlings erected on them. In place of tiles a covering with ordinary boards may also be used. The structure is then encased with peat, and over this is placed another layer of peat sods. The whole is finished off with a layer of ground about three feet thick, which is planted with grass seed. A similar ice stack is also fully described in Vol. II, page 364, of ICE AND REFRIGERATION.

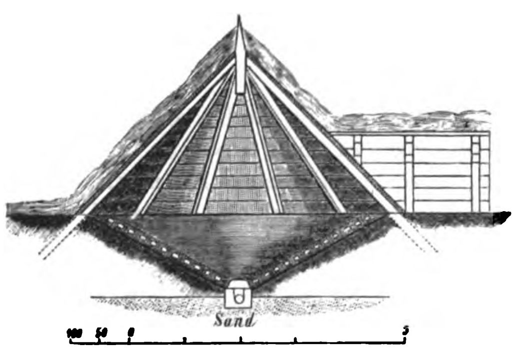
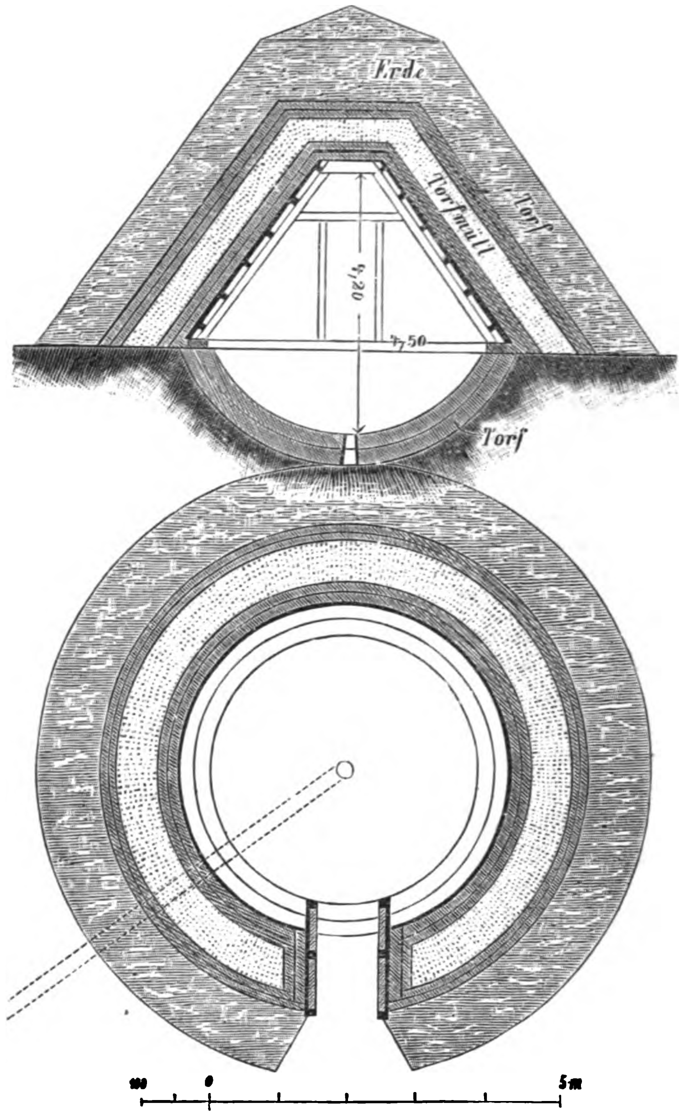


FIG. 17.



FIGS. 20 AND 21.

Ice houses built under ground are more or less a thing of the past, since the heat exhaled by the ground and other inconveniences impair their usefulness considerably. Nevertheless, for the sake of completeness, a few samples of structures of this kind may be described here. The one illustrated in Fig. 22 is a very simple one. The ice room proper is wholly underground, surrounded by masonry two bricks strong; after this is an air space twenty-five cm. wide and another course of masonry one brick strong. The plank floor rests on oak joints impregnated with chemicals. The floor below is slanting toward the center, where it connects with a drain for the water to flow off. The structure is provided with a tent

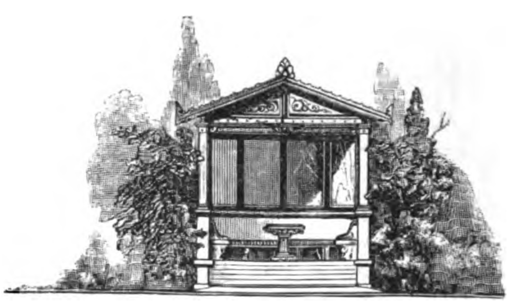


FIG. 24.

frame, nailed up with boards inside and outside, the space between being filled with ashes. On one side the roof terminates in an entrance which can be closed off by means of a dopple door. The roof and entrance are covered with a layer of straw.

The underground plant illustrated in Fig. 23 is constructed a little more elaborately, involving the principles

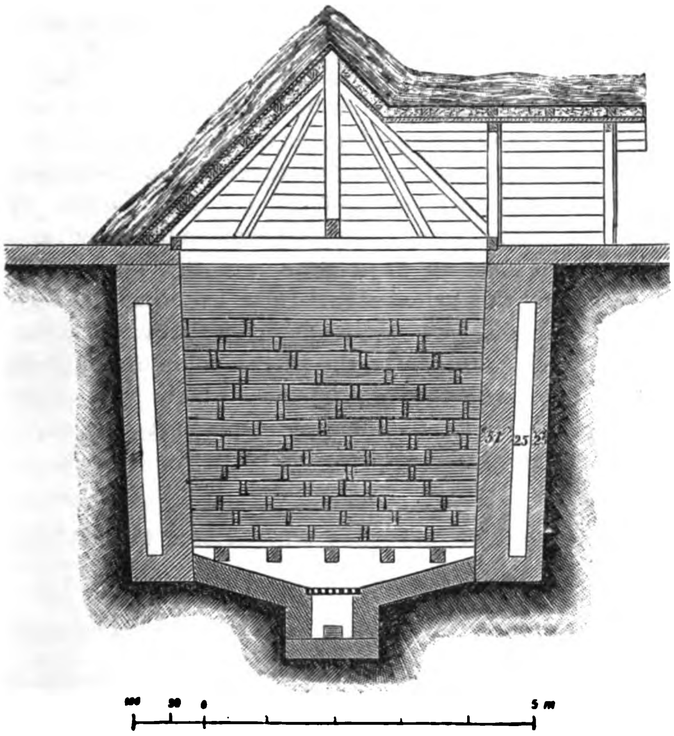


FIG. 22.

first laid down by Brainard for keeping dry ice houses, ice boxes, etc. It is well known that the moist air which is due to the melting of the ice causes a deposit of moisture on the arched ceilings, which trickles down in the form of drippings, which, while passing through the ice below, hastens the wastage of the latter. To prevent this it has been suggested to remove the moist air by ventilation; but this causes the outside warm air to enter the ice house, which also induces the melting of the ice. Brainard avoids the ventilation by making the ceilings and walls of corrugated sheet metal, forming little channels in which the deposited moisture collects and is carried away without coming in contact with the ice. If an ice house is kept very cold, sometimes the water deposited on the ceiling freezes on the sheet metal, in which case the ice house remains pretty dry. The ice house illustrated in Fig. 23 is provided with a ceiling constructed after Mr. Brainard's plan. The side walls are formed by scantlings, and cross-pieces are lined inside with cork bricks and outside with common bricks.

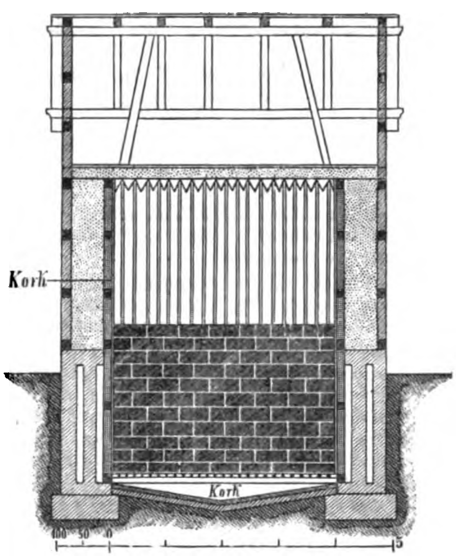


FIG. 23.

The cork bricks are excellent as non-conductors of heat, and do not waste away. The space between the inner and outter walls is filled with charcoal or ashes. The interior wall is covered by strips, between which the water flows off. Below the plank floor there is a small conical pit, lined with cork stones laid in straw and bedded on a floor made of wooden strips. This arrangement keeps out the heat of the earth from below.

A further example of an underground ice house is illustrated in Figs. 24 to 29. It was constructed under peculiar conditions and in accordance with exceptional requirements, and may well serve as an illustration as to how a useful purpose can be served in combination with agreeable and beautiful features. In the case in hand an ice house was wanted to supply the family of a manufacturer, as well as those of his employes, in sickness or other emergencies during the summer time, and the only place available was the garden in the rear of the residence. Consequently that portion of the ice house exposed to view had to be so constructed and utilized as to be a decoration rather than otherwise. The architect accomplished this by making a sort of a pavilion out of that portion of the ice house above ground which fronts toward the residence. This pavilion shows the form of a semi-circle in the ground plan (see *g*. Fig. 29), and furnishes room for a semi-circular bench and table, which offers a cool resting place in summer time. The opposite side of the ice house—that is, that portion above ground—fronts on a rear street or alley adjoining the rear of the garden, and is so arranged

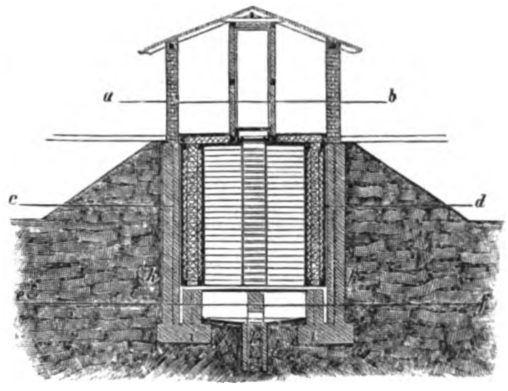


FIG. 25.

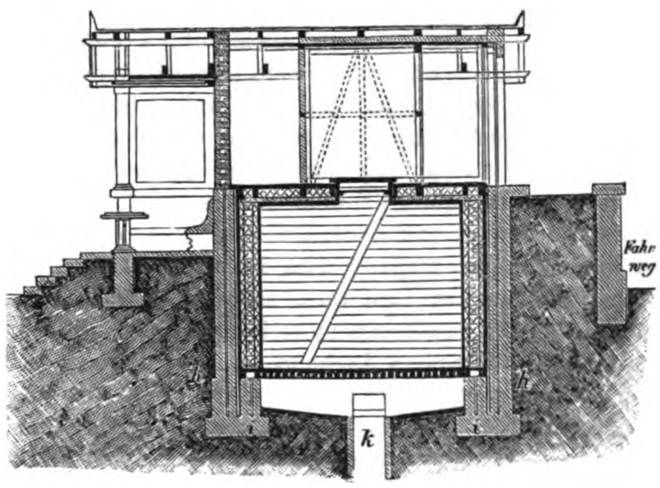
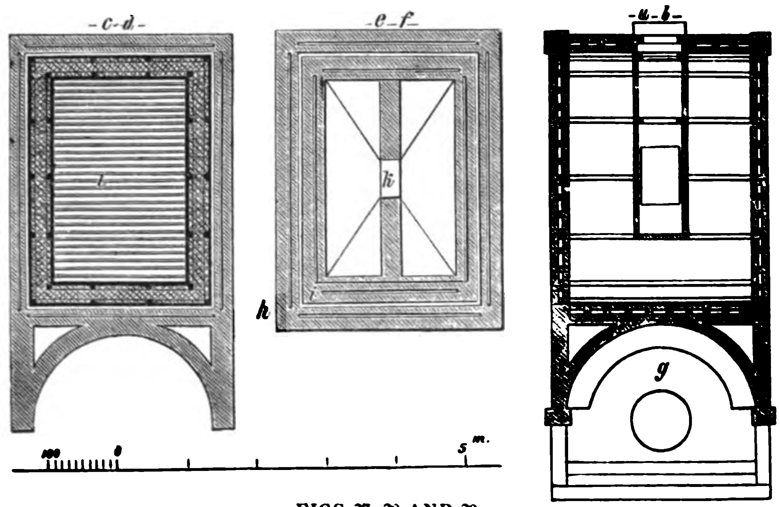


FIG. 26.

that the ice can be brought in from that side, as shown in Fig. 26. The other arrangements are readily understood from the drawings. Fig. 28 shows a ground plan of the foundation after the line of the section shown in Fig. 25; *h* represents the foundation of the outer walls, and *i* the foundation of the inner wall on which the ice box rests; *k* is the catch basin for the water from the

melting ice. Fig. 27 shows the ground plan of the ice box, *l*, with the pavilion. The ice box rests on a frame of oak timbers, and the insulation is effected by straw and sawdust. In storing or withdrawing ice the passageway shown in Fig. 29 is made use of. A ladder, indicated in Fig. 26, leads down to the bottom of the storeroom proper. The roof is covered with roofing felt. Trees and shrubberies planted around the neighborhood of the ice house offer further protection against the radiating heat in summer time.



FIGS. 27, 28 AND 29.

THE Sheep Breeders' Association, of Canada, held its annual session in the city of Toronto, Canada, December 7. Among the papers read was one entitled "Canadian Packing Houses," by Mr. Holland, of Toronto, who told his hearers that there would be no advantage to their industry in free trade with the United States. Canada must look to Europe for her market for animal products. The withdrawal of the preferential conditions under which cattle were formerly exported to Great Britain emphasized the necessity of pushing the trade along fresh lines. He thought that the only way was to establish packing houses, slaughter yards and cold storage warehouses similar to those in Chicago. In closing he referred to the formation in Toronto of a packing and storage company with a capital of $500,000. Richard Gibson, of Delaware, asked if it was not the intention of the new company to import hogs and steers from the United States in bond for slaughter. Alderman Hallam replied that the company would not do so if the Canadian farmers would raise enough animals. The present slaughter houses could handle more hogs than they could obtain.

THE Credits Commutation Co., the new company that has undertaken to straighten out the inexplicable combination of business complications at Sioux City, which has just completed the organization of the stock yards property there, announced December 26 that it had completed arrangements to put the Sioux City Packing Co., a branch of the Anglo-American Co., of Chicago, in a house with a capacity of 5,000 hogs and 500 cattle per day at the stock yards. The change is to be made soon after January 1. The house now occupied by the company, which has a capacity of 2,000 hogs a day, is to be leased to another company, a new one at Sioux City, the name of which the Credits company will not now divulge. Michael Cudahy is also to be established in the new dressed beef plant early in 1894. It has a capacity of 1,200 cattle and 500 sheep per day.

LONDON is said to be "threatened" by a new source of supply of frozen meat, the Cape Colony, South Africa, having discovered that they have mutton to spare and can get it to London in marketable condition. Queensland, Australia, is also said to have gone into the business of exporting salted meats in an experimental way. There is, however, a suspicion that in these dull times, at any rate, the British colonies are likely to overdo this new business which, in the light of New Zealand's past happy experience, seems to hold out such glittering promises of profit.

PACKING HOUSE NOTES.

—Armour & Co. will build a refrigerator at North Adams, Mass.

—The Augusta Packing Co. has begun business at Augusta, Ga.

—The Xenia, Ohio, packing house will soon resume operations.

—Nelson Morris & Co. will build a $15,000 refrigerator at Decatur, Ill.

—Armour & Co.'s new meat cooler at St. Augustine, Fla., is completed.

—It is reported that Armour & Co. will build a meat cooler at Akron, Ohio.

—Hammond & Co. will invest $3,000 in a meat cooler at Dubuque, Iowa.

—The new Cudahy (Wis.) packing houses are running nine hours daily.

—It is expected that the packing house at Nebraska City, Neb., will resume business by January 1.

—Wm. Plankinton will operate the Plankinton house at Milwaukee, lately vacated by the Cudahys.

—The Silberhorn Packing Co., Chicago, will begin operation at Sioux City, Iowa, January 1, killing 3,500 hogs and 500 cattle daily.

—Geo. L. Botsch's Sons, packers, Washington, D. C., have put in a new refrigerating plant built by the Remington Machine Co.

—The Armour Packing Co. has opened an agency in Copenhagen, Denmark, for the sale of their products to the Baltic countries.

—Schwartzschild & Sulzberger, Kansas City, will put up an addition to their plant 180×120 feet in size, and spend $100,000 in improvements.

—The G. H. Hammond Co. has let the contract for the construction of a pork house at Hammond, Ind., the structure to be of stone and wood, and the dimensions 60×400 feet. The improvement will cost between $25,000 and $50,000.

—December 13, the Swift Packing Co., East St. Louis, Ill., reduced wages of butchers from $4.50 to $4. A number of the men quit work, but their places were at once filled by new men. In Morris' house, at the same time, 200 men struck, owing to reduction of wages from 45c. to 30c. per hour.

—Schwartzschild & Sulzbergen, Kansas City, will put 100 men at work in the pork house after January 1. A fully equipped hog killing department was put into this plant when it was known as the Kansas City Packing Co., five years ago, but it has been but little used since that time. The machinery is now being overhauled and repaired, and a new chute connecting with the killing room is being constructed.

—November's exports statistics show a falling off in cattle of 3,667; in canned beef of 1,066,233 pounds; in salt beef, 1,325,427 pounds; in fresh beef, 6,746,190 pounds; in oleo butters, 186,362 pounds; in oleo oil, 575,966 pounds; in tallow, 161,312 pounds; in bacon, 8,364,440 pounds; in pork, 1,637,215 pounds, and in lard, 15,398,715 pounds. Hogs and hams have a little more than held their own, showing an increase in the former of 51 and in the latter of 295,354 pounds. Expressed in money the shrinkage is $2,223,461.

THE ICE TRADE

IMPURE ICE AGAIN.

THE "impure ice" agitation has again broken out in several cities—happily at a time when the trade can be protected from loss. Health officers, as a rule, have a most outrageous way of letting a dealer cut all the ice he needs and spend his money to put it into his house before they discover (?) that the ice is impure, and forbid him the right to sell it. This dead loss can be prevented by passing upon the water of the lakes, ponds or streams before it is stored as ice. The ice dealer then can cut it at his peril. The example, then, of Health Officer Lemen, at Denver, in indicating from what lakes he will permit ice cut to be sold, is as fair to the trade as it is unusual in health office practice—usually as autocratic as tax collecting by the sultan of Morocco, and quite as unreasonable.

DR. Sheard, of Toronto, Canada, has decided that the cutting of ice from Toronto bay for any purpose bringing it into contact with food must absolutely cease. In the course of analysis he has found not less than 210,000 colonies of bacteria per cubic centimeter in water taken off the foot of Yonge street slip.

The lowest proportion was found in the old filtering basin on the Island, where but forty-four colonies were discovered in the same quantity. Lake Simcoe water is very pure, only twenty-one colonies being found two feet below the surface in deep water. In consequence of the tests made, the medical health officer will submit the following draft regulations of ice cutting regulation for adoption by the local board of health:

No one shall cut or store ice in Toronto without a permit, for which a fee of $5 will be charged for domestic use and $20 if for cooling purposes.

"All ice stored for cooling purposes shall be sealed up by the health department, and not opened without the written consent of the medical health officer.

No ice for domestic use shall be cut from any portion of Toronto bay, Ashbridge's bay, the River Don, the Humber river or any pond not approved of by the medical health officer; but he may allow ice for cooling purposes from Toronto bay or elsewhere, providing it is stored in sealed houses.

The medical health officer may grant permission for ice cooling purposes, to be delivered to tradesmen and others (except milk dealers and dairymen) who have provision for separate storing. The wholesaler to furnish names of his customers before beginning to supply them, deliver in separate wagons, enter into bonds for $100 that he will not supply any one else, and undertake to keep the ice sealed. Failing to do so, the wholesaler will be subject to the penalty of these regulations.

Ice for domestic use and cooling purposes shall not be stored in the same building.

Any person convicted of a breach of these regulations shall pay a penalty of not less than $5 nor exceeding $20, or go to jail for one month. The presence of any ice stored contrary to these regulations shall be deemed a nuisance to public health, and be dealt with by the medical health officer as such.

ICE CUTTING REGULATIONS.

——The St. Louis local law prohibits ice cutting by any person from any pond in the city without a permit from the health office; all ice sold by dealers must be identified by describing the source from which it was cut.

——The officer at Denver has carefully examined and analyzed the water of all lakes about Denver from which ice is cut, and has found that some are all right and some are bad. He has set five parts of foreign matter in 100,000 parts of water as the limit of pollution to be permitted. In water the amount of foreign stuff usually permitted is four parts in 100,000, but Dr. Lemen lets ice go one better on the germs. He will issue permits to cut ice on Lakes Argo, Grandview, Archer, Aurora, Marston and Church; ice cutting will not be allowed on Lakes Capital, Armour, Maddock, Smith, Rocky Mountain, Berkeley, Lakeview, Sloan's, Cooper and Baker. The officer says: "We find that lakes which are the basin or drainage center of land not cultivated are purer than those into which cultivated land drains. After a prolonged dry spell, also, the water is much purer. These analyses were made after the fall dry spell, so no injustice is done. The artesian water used by the ice makers is found with a very low percentage of foreign substance." The heaviest cutting heretofore has been on Rocky Mountain, Berkeley, Sloan's and Smith's lakes, all of which are now "taboo," and the decision of the health commissioner will be severe on the ice men whose storehouses are on their shores.

MR. Luis Morales, whose portrait appears on the front page of this issue, is proprietor of the ice and chocolate factory illustrated in the issue of ICE AND REFRIGERATION for September, 1893.

REWARDS FOR DISCOVERIES.

The committee on "Science and the Arts" of the Franklin Institute, Philadelphia, call the attention of ingenious men and women to the fact that the Franklin Institute may grant or recommend the grant of certain medals for meritorious discoveries and inventions which contribute to the promotion of the arts and manufactures. These are as follows:

Elliott Cresson Medal (gold), founded in 1848; granted "for some discovery in the arts and sciences, or for the invention or improvement of some useful machine, or for some new process, or combination of materials in manufactures, or for ingenuity, skill or perfection in workmanship."

John Scott Legacy Premium and Medal ($20 and bronze medal), founded in 1816; granted as a reward to "ingenious men and women who make useful inventions," on recommendation of the Franklin Institute.

Edward Longstreth Medal of Merit (silver), founded in 1889; awarded for "useful invention, important discovery and meritorious work in, or contributions to, science or the industrial arts."

Full directions as to the manner and form in which applications for the investigation of inventions and discoveries should properly be made will be sent to interested parties on application to Wm. H. Wahl, secretary, Franklin Institute, Philadelpha.

FIRE AND ACCIDENT RECORD.

——Haines & Co.'s ice house at Wrightsville, Pa., was blown down November 24; loss, $100.

——E. Ball's two ice houses at Pleasant Valley, near Wheeling, W. Va., were burned December 8; loss, $5,000; cause, incendiary.

——While a gang of B. & O. railroad carpenters were at work tearing down Swift & Co.'s ice house at Bellaire, Ohio, the roof fell in, seriously injuring seven men.

——The Newark Ice and Cold Storage Co.'s plant at Newark, Ohio, erected a year ago at a cost of $25,000, was burned December 4; loss, $30,000; insurance, $4,000; cause, unknown, the fire originating in the boiler room. The stockholders, just prior to the fire, had declared a 6½ per cent dividend on last year's business.

——H. M. Flagler's new hotel, the "Royal Pionciana," at Lake Worth, Fla., to be opened February 1, is supplied with a "Remington" ice making and refrigerating machine.

IT is rare that ice cutting begins before the 15th of December, but in this year of 1893 some ice had been housed by that date in the Northwest. However, the total tonnage cut up to this time of this year's ice has been comparatively inconsiderable. It appears, however, from reports in hand that the trade is well prepared for the harvest to come after January 1; that ice house building has been pretty free during the past few weeks, though probably the number of new houses is not equal to that of this time last year; and that many enlargements of storage capacity have been consummated. The outlook, then, for a busy season is very good indeed. As to particulars, we condense our information in the paragraphs below.

THE ice men at Bangor, Me., are not as cheerful as might be, perhaps, if conditions were different. Said one leading dealer the other day: "What's the use for us to think of cutting much ice down here? There is half a crop on the Hudson now in the houses, and the amount we cut down here is regulated by that. Of course if there isn't much housed there this winter there will be some business here. There's a big lot left over here now, enough to almost supply what would ordinarily be sold. The American and Katahdin companies will cut some, but I don't hear that many of the other concerns will. If we were sure of selling our ice for seventy-five cents a ton it would pay us to cut, although there isn't any money in it at that price. It costs us from twelve to fifteen cents to cut and house it, and about thirty cents to load. Shrinkage, etc., will bring the cost up to fifty cents a ton sure, and then there is the interest on the money and the risk you have to run. But if we could get along and just pay our expenses it would help out the laborers here, and we would be willing to take our chances."

The temper of the trade is, perhaps, expressed by the following from Bangor: "There is one concern on the river, Hodgkins & Hall, that struck it rich last winter, all because their crew went on a strike. They were intending to cut about 30,000 tons, and had housed about 5,000 when their men struck. They didn't give in and no more ice was cut. From the way that commodity has been selling they think they are about $2,000 in, thanks to the walking delegate."

NEW ENGLAND was well frozen up by December 14, and on that day the climax was reached by a temperature of —30° in northern New England and Canada, —40° in some localities in Vermont, —1° in Boston, and so on. As early as December 6 a telegram from Richmond, Me., said that on the 5th "the thermometer dropped to a point below zero; the Kennebec took a handsome freeze, and with one exception the ice fields, both above and below here, are satisfactory to the ice men." The river never was in a better condition for freezing than this season, it is said. The water is clear and exceptionally free from grit; and the outlook for a good winter's run is most promising, there being every indication that the usual amount will be harvested.

ON DECEMBER 21, Superintendent Province received orders to suspend work at the houses of Charles Russell & Co., Richmond, Me., until further notice. The above action is said to be due to cold weather in the South, where an unusually large amount of ice is likely to be harvested. Two or three other plants are affected by the order, all of which are controlled by the Consumers Ice Co., of Baltimore. "If this order should not be revoked, the ice business in this vicinity would be materially affected by it," says a correspondent. "It is not probable that large fortunes will be made on the Kennebec this season. Owing to the great body of snow on the ice the expense of harvesting will be much greater than in recent years."

THE Hudson at Albany was frozen over by December 14; and the ice was sufficiently strong to permit board walks to be laid over it to enable enterprising dealers to stake off their routes. Navigation on the upper river had then ceased.

IN MINNESOTA, at the fields operated by the St. Paul and Minneapolis companies, the ice was eight to ten inches thick by December 8, and it was announced that cutting would begin by the 20th. At Duluth the trade was ready to begin the work on December 11. At Winona clearing the ice of snow began on December 7.

THE annual harvest in northern Indiana, in the neighborhood of Hammond, will be as large as usual, and was ready for the workmen by December 25. The cut requires 500 men, who, as a rule, work day and night until the crop is in the house.

AT INDIANAPOLIS the trade will carry over considerable ice from last season, and it is announced that the outlook for the firms which gather natural ice is not as promising as in years past. One new artificial ice manufactory is going up, backed by ample capital—the Crystal Ice Co., the plant to have a capacity of 100 tons a day. The plant now in operation will manufacture as much more. Another firm is being organized which will build a plant to manufacture artificial ice.

NOTES FROM THE HARVEST FIELDS.

——The Duluth Ice Co. will cut 17,000 tons, an increase of 2,000 tons.

——The ice dealers at Sioux City began cutting 12-inch ice as early as November 30.

——The Kennebec territory is credited with 450,000 tons carried over from last harvest.

——At Fort Dodge, Iowa, claims were staked out on 8-inch to 10-inch ice by December 8.

——The cut at Quincy, Ill., will require 500 men, the average wages being $1.50 per day.

——The dealers were at work housing ice at Salt Lake City December 1. The ice was good, but not as thick as desired.

——John Hilt & Co., South Bend, Ind., expect to increase the cut this season, and are building more houses to hold the ice.

——Thos. Spencer, of the Norwood Ice Co., Providence, R. I., had a large number of men cutting 8-inch ice at the Ponegansett ponds. It will be used for the winter trade.

——It is expected that the cut at Bean and Sugar lakes, near Atchison, Kan., will be greater this year than last, if the season is favorable, the packers of Kansas City taking the surplus.

——The cut at Minneapolis will exceed 200,000 tons, an increase of 20,000 tons, and does not include 60,000 tons carried over from last year. New houses have been built on Cedar lake to hold the increase.

——There was 10-inch ice in the upper Hudson on December 15.

——Greene & Sheldon, West Fitchburg, Mass., began cutting ice December 20.

——The Consumers' Ice Co., Burlington, Vt., began cutting 12-inch ice December 20.

——E. & G. Brooks Iron Co. began harvesting 6-inch ice at Birdsboro, Pa., December 15.

——Ice cutting began on Illinois river at Peoria and Pekin, Ill., December 11 at all the houses.

——Ice cutting was in progress at Dubuque, Iowa, December 20, the work being on 12-inch ice.

——Ice cutting at Spring lake, Palmyra, Wis., December 18. The ice was about a foot thick, and of superior quality.

——Beyerstedt Bros., Winona, Minn., began cutting for the W. & St. P. Ry. Co. December 12, from the lake at Waseca.

——Pittman & Deane Ice Co., Detroit, will cut their ice at Drayton Plains, Mich., and had 5-inch to 8-inch ready to cut December 15.

——Samuel Cessar has a new ice stack under way, at Dalton, Mass., which will be 55×120 feet, and will have a capacity of 2,000 tons of ice.

——It is reported at Reno, Nev., that on account of the "pooling of issues" by the National and Union ice companies, the Tahoe Ice Co. will cut no ice this winter.

——The Water Works Co., Creston, Iowa, have made a contract with the C., B. & Q. road to furnish the ice used on the Iowa lines. From 100 to 200 men will cut the ice from the Creston water reservoir.

——The Sioux City men were ready to begin ice cutting (10-inch and 12-inch ice) by December 18, and some ice was cut prior to December 23, when a thaw and a rain came and stopped the work. It is expected that more ice than ever will be housed in the city.

——The harvest was ready at Lincoln, Neb., December 12, when the ice was a foot thick. The estimated cut to be made is 100,000 tons, including a small surplus left over from last season. The Lincoln Ice Co. will lead among the regular dealers with 20,000 tons or over.

——The ice dealers of Connecticut began harvesting by December 18. In many places, at that date, the dealers had already housed a large quantity from the ponds, and were confident that before the middle of January the harvest will be completed. The ice dealers in New Hartford December 19 were putting into the houses ice that was ten inches thick, and had already harvested over 500 tons.

——A rumor was started in ice circles that the Kennebec ice crop was endangered by the salty state of the river, and that unless heavy rains should swell the latter no ice would be housed on the Kennebec this season. Mr. W. A. Province, superintendent of the Charles Russell Co., says that the rumor is without foundation. The river is low, but there is no trouble with the ice. Sample pieces melt down as clear as plate glass when put to steam test.

——The Portland, Me., *Advertiser*, December 8, says: "The ice houses on the Kennebec are all ready for ice, and the prospects are bright for a good freeze. The Cony & White house at Augusta has been repaired to hold 3,000 tons; Mr. George B. McClench has cleared the ground for 12,000 tons at the old Page place; Capt. Rich has an empty capacity of 60,000 tons. The Knickerbocker Ice Co. have the sills laid at Farmingdale for 40,000 tons, and have 30,000 tons at Randolph, 40,000 tons at Smithtown, and 30,000 tons at houses at Iceboro. Haynes & Lawrence have 12,000 tons and the John Hancock 20,000 tons at Randolph; the Great Falls Ice Co., 30,000 tons at Pittston and 45,000 tons at South Gardiner; the Independent, 60,000 tons; the Consumer houses, 40,000 tons; Clark & Chaplin, 20,000 tons; E. D. Haley, 20,000 tons; Cochran & Oler Ice Co., at Berry houses, 30,000 tons, and sills laid for 25,000 tons more; Cedar Grove, 30,000 tons; Richmond houses, 25,000; Swan Island, sills for 10,000; Morse Ice Co., Lincoln, 20,000 tons; Twings Point, 40,000 tons; Charles Russell & Co., Stern's Point, 35,000 tons; Richmond, 29,000 tons; Morse Brothers, Bowdoinham, 10,000 tons."

NATURAL ICE NOTES.

——E. T. Stull has built an ice house at Utica, Ind.

——Fox & Son have built an ice house at Racine, Wis.

——Wm. Pelcer will build an ice house at Tobias, Neb.

——Casper Nehus is building an ice house at Freeport, Ill.

——C. D. Preble has enlarged his ice storage at York, N. H.

——H. D. Matthew has built an ice house at Womeldorf, Pa.

——Col. Wm. Teke will enlarge his ice house at Dillsboro, Ind.

——Whitney Bros. are building an ice house at Pilot Valley, N. H.

——James Morton will build an ice house at Thomaston, Conn.

——C. M. Gale will enlarge his storage room at Wales, Conn.

——Geo. G. Crozier is building an ice house at Port Royal, Penn.

——Benj. Hayes has built an ice house, 20×80 feet, at Hammond, Ind.

——Jellum & Wall will build additional ice storage room at Sioux City.

——Whiting & Sons are building an ice house at North Truro, Mass.

——C. W. Illsley, Arlington, Mass., is building a large house on Spy pond.

——Pastors & Luper are building an ice house at Portland station, W. Va.

——Peter Garretson is building an ice house at Hillsborough, N. J.

——The Fresh Pond Ice Co. will build three new houses at Brookline, N. H.

——Richardson & Ahrens are building an ice house at Rehrersburg, Pa.

——The ice men at Pekin are getting their houses in order for the new cut.

——S. Dales is pulling up a 300-ton ice house at Stockton, near Galena, Ill.

——W. F. Fay is building a new house at Barre, Mass., to double his capacity.

——McMillan's new ice house at Columbia, Pa., will be 123×40 feet in size.

——Smith & Robinson are rebuilding a house at La Crosse, Wis., recently burned.

——Chr. Jeannerette is building an ice house at Logansport, Ind., to hold 12,000 tons.

——B. S. Houck, Mercer, Pa., has repaired his old ice house and built a new one.

——W. H. Dunn & Co. are building an ice house 75×40 feet in size at Hagerstown, Md.

——A. L. Lund is building an ice house at Jefferson, Wis., to enlarge storage capacity.

——Randall & Underwood are building a large ice house at Starlight, near Honesdale, Pa.

——C. H. Drummond is rebuilding his ice house at Waterville, Pa., enlarging its capacity.

——The Knickerbocker Ice Co. will put up no ice at the Randolph (Me.) houses this season.

——The Grand Trunk road is getting ready to harvest the ice used by that road at Vicksburg, Mich.

——Fred Jaeger will erect a two-story ice house, 42×100 feet in size, on Spruce street, Columbus, Ohio.

——December 6 the Magee-Walton Ice Co., Hamilton, Ont., received an order for twenty cars of new crop of ice for Buffalo.

——A. L. Stead has purchased land at Dixon, Ill., on which he will build an ice house, and enter into that trade next summer.

——The asylum for feeble minded children at Lincoln, Ill., is building an ice house, to cost $1,515, and to be ready for use January 15.

——The Upper River Ice Co., Fort Dodge, Iowa, has erected another large ice house near their old building, thus doubling their capacity.

——Mason City, Iowa, ice dealers are getting ready for the harvest. Some ice has been carried over from last year; but 4,000 tons will be cut.

——J. H. McGregor is adding a new ice house to the ones already standing at his ponds east of Bloomington, Ill. This one is 120×30 feet and 26 feet high.

——The Hammond Ice Co., Waterford, Ont., have decided to build a new ice house, which will be much larger than the one which was taken down last summer.

——Valentine Baker, Champaign, Ill., is building an ice house, 30×60×22 feet, to hold 700 tons, giving him, with his houses at Crystal lake, storage capacity of 2,400 tons.

——The National Ice Co. have completed the excavation and the dams on their ponds at Reno, Nev., which gives them several acres of surface, or enough to fill their house by one cutting.

——The South Milwaukee Ice Co., South Milwaukee, has been organized by George Morgan and Herman Grote. They have purchased the right of the ice crop at the mill pond from Messrs. Ahrens.

——The Reno, Nev., ice companies, with houses up the river, as early as December 5, had their ponds ready to freeze and were waiting for a cold snap to do the work. Last year's crop of ice is about all disposed of, there being but about 15,000 tons left over.

——The Providence syndicate who occupy the west side of Wallum pond, near Worcester, Mass., have had some sixty or more men at work clearing ground for the building of ice houses to cover 157×182 feet, with capacity for 50,000 tons of ice. Three other buildings will be erected later to make a total capacity of 200,000 tons.

[*Reprinted from* OFFICIAL DOCUMENTS.]

ON CANNED VEGETABLES.

METHODS OF PRESERVING—PRESERVATIVES EMPLOYED—USE OF COPPER AND ZINC—VESSELS USED—FOOD VALUE OF CANNED GOODS.

A BRIEF history is given of the process of preserving foods by sealing them at a high temperature from contact with the external air. It is shown that it was originally believed that the success of this process was due to the exclusion of the oxygen. The error of this, however, is set forth and the true theory developed, which rests upon the fact that the germs or micro-organisms capable of inducing decay of the food are killed by the high temperature. The exclusion of the external air prevents the access of new germs, and thus the foods are preserved simply because the organisms which produce putrefaction cannot be introduced.

It is shown that a temperature high enough and sufficiently prolonged to kill these germs in vegetables tends to disintegrate many of them and render them less attractive to the eye than when in the natural state. For this reason canners have sought other methods of preserving the foods in such a way as not only to preserve them from decay, but also to preserve their natural attractiveness. The preservatives which have been used for this purpose, and which have been found to the largest extent, are salicylic acid and sulphurous acid, the latter usually in the form of sulphites. Other preservatives are also sometimes used, such as boric acid, saccharin, etc. The action of all these added preservatives, together with a discussion of their physiological effects, as gathered from the experience of physicians and others, forms a prominent part of the bulletin.

PRESERVATIVES EMPLOYED.

Opinions are divided in regard to the wholesomeness or unwholesomeness of these added preservatives, the great weight of testimony being to the effect that while these bodies in small quantities are not injurious to health, yet the continual use of them, even in such small quantities, may finally become prejudicial. It is also shown that the same qualities which enable these preservatives to prevent the action of micro-organisms, and thus preserve the food from decay, are also active in the digestive organs and hinder the normal functions of the digestive ferments. In other words, the forces which tend to preserve in this way the vegetables from decay also tend in like manner to retard the processes of digestion. The fair conclusion from the data which follow in this bulletin is, without doubt, that the use of added preservatives in canned vegetables is objectionable. This conviction, however, is not strong enough to warrant the absolute inhibition of these bodies, but the consumer would be sufficiently protected if the law should require that on each can of preserved vegetables a statement should be found as to the character of the preservative used and the amount of it which has been added. The consumer and his medical adviser are thus properly forewarned of the danger which they may encounter in the way of such foods, and if in the face of this announcement they see fit to continue their use, it is a matter which rests solely with them, and they cannot hold the guardians of the public health responsible for any ill effects which may follow. Concisely, the views which we have reached as a result of these investigations are these: *First*, that the use of added preservatives is, upon the whole, objectionable; *second*, that their absolute inhibition is not warranted by the facts which have come to our knowledge; but in all cases their presence should be marked upon the label of the can.

THE USE OF COPPER AND ZINC.

There are other added chemicals which are found in many varieties of canned vegetables, which are used not especially for the purpose of preserving them, but for adding to the attractiveness of their appearance. I refer chiefly to the use of copper and zinc salts to secure and preserve the green color of canned peas, beans, etc. The use of copper for this purpose is a very old one. Long ago it was observed that the cooking of peas, beans and other green vegetables in imperfectly cleaned copper vessels would secure a deeper and more attractive green appearance for the cooked product. It did not take the observing cook long to discover that this improvement in appearance was due to the copper or zinc present in the copper or brass vessels. The same effect was found to be produced when these vegetables were cooked in ordinary vessels with the use of small quantities of copper or zinc salts. Upon the whole, copper salts were found more convenient for this purpose, and hence at the present day an immense industry has grown up in the greening of canned vegetables by the use of copper and zinc, especially of the former. By consulting the analytical data which follow it will be found that a large part of such canned goods exposed for sale in this country has been greened by the addition of copper, and in some cases of zinc. For instance, the amount of copper found in peas of French origin was uniformly much greater than that found in American canned peas. Of forty-three samples of American canned peas examined 32.56 per cent were found to contain no copper, while 67.44 per cent were colored with copper. Of thirty-six samples of French peas all were colored with copper, except one, which was colored with zinc. In regard to the quantity of copper found the following comparison will be of interest:

Amount of copper per kilogram.	American peas.	French peas.
	Per cent.	*Per cent.*
Less than 10 mg. copper per kilo	30.23	0.00
Between 10 and 18 mg. copper per kilo	11.63	5.74
Over 18 mg. copper per kilo	25.58	94.29
Over 25 mg. copper per kilo	16.28	88.57
Over 50 mg. copper per kilo	6.98	60.00
Over 75 mg. copper per kilo	0.00	31.43
Over 100 mg. copper per kilo	0.00	11.43

The literature on this subject, it will be found, has been carefully collated in the pages which follow, and, as in the case of added preservatives, it is difficult to come to a definite conclusion in the matter. Almost the same statements may be made in regard to the use of greening materials as have been made in respect of added preservatives.

The occasional use of a small quantity of a copper or zinc salt, it must be allowed, can be practiced without practical injury to health. On the other hand, the continual and regular consumption of even the small quantities of these materials present in canned vegetables must be regarded as at least prejudicial to health. Therefore it is concluded that the public health will be sufficiently conserved provided each can of vegetables

which has been greened artificially in this way shall bear plainly marked upon the label the nature of the greening material and the amount thereof employed. The responsibility of the use of these vegetables will then be thrown upon the consumer, and he can exercise his own judgment in regard to the matter.

The question of the use of copper in canned goods has been agitated in France for nearly a quarter of a century. At first the committees appointed by the government to investigate the matter reported uniformly against the use of copper for greening. While French packers were not allowed for some time to sell their copper treated goods to French consumers, they were not prevented from using copper when the goods were intended for export. For instance, in 1875 some Bordeaux packers labeled their goods "Green peas (or beans) greened with sulphate of copper. Made specially for exportation to America and England, and not sold for French use." Copper was present in some of these samples to the extent of forty mg. per kilo. After this practice had gone on for some time the board of hygiene of the Gironde concluded to prohibit it, stating that no distinction should be made between goods destined for exportation and those intended for home consumption. Nevertheless, there was such a demand for goods of this kind that the exigencies of commerce gradually got the better of the hygienist, with the result that the French government has finally permitted the use of copper in greening canned vegetables, requiring, however, that some definite mark shall be used in connection therewith. The canners, however, were shrewd enough to elude the necessity of marking their goods as having been greened with copper or zinc and fulfill the letter of the law, if not the spirit, by marking them with some indefinite mark such as *a l'anglaise*. The result is that the purchaser of these goods has no intimation, as far as the label is concerned, of the nature of the material which is employed in greening, and the canners themselves claim that if they were compelled to mark their goods as having been greened with copper or zinc it would entirely destroy their sale. The question here is one of sight and not of taste or digestive value, and it seems that it would be wise to recommend to the consumer of canned goods to be content to use them, even if they are slightly pale or yellow, rather than to have them of a bright green color at the possible expense of health and comfort. The vast extent of the practice of greening foods, together with the amounts of greening material which have been found in the different cans, will be seen by consulting the analytical details which follow.

VESSELS USED.

Another prominent feature of the work which we have conducted is found in the examination of the vessels containing the vegetables. In Germany the law requires that the tins employed for holding the canned goods shall not contain more than 1 per cent of lead. In this country there is no restriction whatever in regard to the character of the tin employed, and as a result of this the tin of some of the cans has been found to contain as high as 12 per cent of lead. There is no question whatever among physiologists in regard to the effect of lead salts upon the human system. The continual ingestion of even minute quantities of lead into the system is followed eventually by the most serious results. Painters' colic, lead palsy and other serious diseases well known to physicians are the direct effects of the continual exposure of the system to the influence of minute portions of lead salts. Therefore the greatest care should be exercised in the preparation of canned foods to exclude every possibility of the ingestion of lead. Even tin salts are poisonous, but not to the extent of lead, so that the presence of a minute portion of tin in canned vegetables, coming from the erosion of the cans containing them, is not a matter of such serious import as the presence of lead. Perhaps it would be quite impossible to exclude tin absolutely from canned goods when they are canned in tin, but it is possible to exclude the salts of lead. This can be done by requiring that the tin shall not contain more than, say, 1½ per cent of lead, and, in the second place, that the solder which is employed shall be as free from lead as possible, In Germany the solder employed in sealing the cans is not allowed to contain over 10 per cent of lead, while in this country the analyses of numerous samples of the solder employed show that it contains fully 50 per cent of lead. In addition to this there is no care taken to prevent the solder from coming in contact with the contents of the can. It is a rare thing to carefully examine the contents of a can without finding pellets of solder somewhere therein. Often on examining the inside of a can it is found that large surfaces of solder on the seams are exposed to the action of the acid contents. The result of all this is, as will be found by consulting the analytical data which follow, that lead is a very common constituent of canned goods.

Another great source of danger from lead has been disclosed by the analytical work, viz., in the use of glass vessels closed with lead tops or with rubber pads in which sulphate of lead is found to exist. As a sample of this may be mentioned the goods of Eugène Du Raix, of Bordeaux. All the samples of his goods examined were put up in lead topped glass bottles. All except one contained salicylic acid, and all of them save one contained copper. In one of these samples lead existed to the enormous amount of 35.2 mg. per kilo; in another 15.6 mg. per kilo were found, while in one sample, viz., No. 10937, the extraordinary quantity of forty-six mg. per kilo was discovered.

It is not difficult to see how goods covered with lead tops can be contaminated. It may be claimed that these goods should never be turned upside down, but the shippers pay little attention to such directions, and the result is that the goods may be kept for days or even weeks in such a position as to bring the contents of the can in contact with the lead tops or with the rubber pads containing lead. The constant consumer of such goods, therefore, must run some risk of being exposed to the insidious inroads of some of the diseases peculiar to the action of small quantities of lead upon the human organism. It is not too much to ask that the law should require the canners to exercise the utmost care to exclude all dangers of this kind.

The general result of the examination of the canned goods exposed for sale in this country leads to the rather unpleasant conclusion that the consumers thereof are exposed to greater or less dangers from poisoning from copper, zinc, tin and lead. These dangers could be easily removed if the manufacturers of these goods were required to follow the dicta of a reasonable regard to public hygiene.

FOOD VALUE AND DIGESTIBILITY OF CANNED GOODS.

In regard to the food value of canned goods, interesting data have also been obtained. It will be seen that many expensive articles of canned goods contain an amount of nutrient matter totally out of proportion to the price paid therefor. The conclusion is therefore forced upon us that the use of canned goods is in every sense a luxury, and a luxury which is attended with many dangers. On the whole, the less rich portions of our population should rather congratulate themselves that their incomes do not warrant them in purchasing at a high price foods of so little digestive value and fraught with so many dangers to health. As an illustration of the excessive cost of some goods put up in cans, attention may be called to the analytical data in the tables which follow. These tables will be useful to consumers who have not time to search through all the details of the bulletin.

The quantity of dry food material in canned goods varies within wide limits. It is very low in such vegetables as string beans, asparagus, etc., and quite high in such materials as canned corn, succotash and other bodies of that description. The lowest percentage of dry matter in string beans of American origin was 4.17. In other words, in buying 100 pounds of such material the consumer purchases 95.83 pounds of water.

The price of the packages of string beans varied within wide limits, depending both upon the size of the packages and the labels they bore. The highest price paid was thirty-five cents, and the weight of the contents of the package was a little over three pounds. The lowest price paid was ten cents, and this was paid in many instances. The highest price paid, according to the percentage of dry matter, was in sample 10928, costing thirty cents and containing only 254 grams of string beans, 31.1 grams of dry matter, and 94.37 per cent of water. The price of the dry matter in this package was nearly one cent per gram, which would be almost $5 per pound. The enormous cost of food in canned goods is illustrated to the fullest extent by this sample, showing in a striking way that such food materials must be regarded in the light of luxuries or condiments rather than as nutrients to support a healthy organism.

In regard to the composition of the dry material of string beans of American origin, full data are found in the analytical tables in the body of the report. To illustrate its nutrient value it may be well to give the analysis of the sample just mentioned, viz., 10928. The dry matter of this sample contained 0.46 per cent of matter soluble in ether, presumably of an oily or fatty nature; 8.67 per cent of indigestible fiber; 25.5 of mineral matter, of which 18.37 per cent was common salt and 6.68 per cent of other mineral substances. Of nitrogenous matter in the form of albuminoids it contained 16.16 per cent, of which 11.23 per cent were digestible. Of carbohydrates, including sugar, starch, etc., it contained 49.63 per cent. Of the total solid matter present only 69.19 per cent were digestible. We have here a substance which cost nearly $5 per pound, and of which, in round numbers, only 70 per cent were digestible. Thus the digestible matter cost about one-third more, or about $6.50 per pound.

In regard to the use of common salt in these canned vegetables, it may be said that as a rule it is added as a condiment and not as a preservative. The proportion of it in relation to the whole contents of the can is not very high, but the percentage in the dry matter of the can is very considerable. In one instance, viz., 10923, of American string beans, it was found that 40.58 per cent of the dry matter consisted of salt. In this case the salt evidently had been added either as a preservative or with the fraudulent intent of increasing the weight, more likely as a preservative. The extent to which common salt may be added is a matter which has, I believe, not been regulated by law in any country. There should, however, be a limit even to the addition of this comparatively harmless substance.

The percentage of water in the French haricots verts was even higher than in American string beans. In one instance, No. 10939, the percentage of water found was 96.13.

The percentage of salt in the dry matter of the French product is quite uniform, the maximum being 19.13 per cent and the minimum 8.34 per cent. The percentage of albuminoids is somewhat higher than in American goods, but the digestible albuminoids are in no greater abundance.

GENERAL REMARKS.

A general view of the digestive experiments must lead to the conviction that the process of canning, especially when preservatives are employed, such as salicylic acid and sulphites, tends to diminish the digestibility of the albuminoid and other bodies. The low percentage of digestible albuminoids will be remarked with some degree of astonishment in all the analytical tables.

A careful perusal of the data in the body of the report will not fail to convince every unbiased person that the use of canned vegetables is, upon the whole, an expensive luxury. It is not the purpose of this investigation to discourage the use of such bodies, but only to secure to the consumer as pure an article as possible. Nevertheless these practical conclusions may prove of some help to the laboring man and the head of a family, when he finds himself in straightened circumstances, by assisting him in investing his money in a wiser and more economic way than in the purchase of canned vegetables. An expenditure of ten or fifteen cents for a good article of flour or meal will procure as much nutriment for a family as the investment of $3 or $4 in canned goods would.

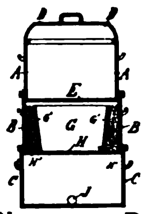
WE are soon to buy milk as we buy ice, says an exchange. It has been demonstrated that milk, if kept in a frozen condition, will retain its qualities for a long time. Sweet milk could be handled to a much better advantage if it were possible to freeze it soon after taking it from the cows. While it now seems impossible on the part of shippers to arrange for congealing milk without an expense attached which would make it unprofitable, it is not improbable that such a scheme will be invented. Such rapid strides in improving the methods in manufacturing ice have been made in the past few years, and it would seem that some of the improvements in ice making could be utilized in freezing milk. In France the experiment of freezing has been tried and found to be a success.

——C. W. McKee has sold his interest in the wood, coal, feed and ice business at Santa Ana, Cal., to Clifton J. Oversheimer. The new firm is now Richardson & Oversheimer.

We append below the most important new patents relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for ICE AND REFRIGERATION.

POT FOR PRESERVING PROVISIONS ON ICE.

No. 509,572.—Emma Feuerherd, Coswig, Germany. Filed July 8, 1893. Serial No. 479,866. Patented November 28, 1893. (No model.)

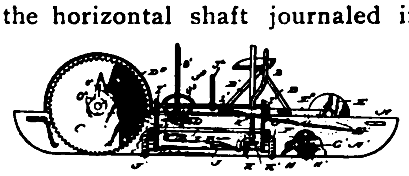


Claim.—The combination of uppermost pot *A*, having perforated bottom *E*, with central part *B*, having bottom *H*, which is centrally perforated and has an upwardly projecting partition *G'*, and with a lowermost pot *C*, substantially as specified.

ICE CUTTING MACHINE.

No. 509,420. Daniel R. Woodsum and Frank M. Woodsum, Sunapee, N. H. Filed May 6, 1892. Serial No. 432,036. Patented November 28, 1893. (Model.)

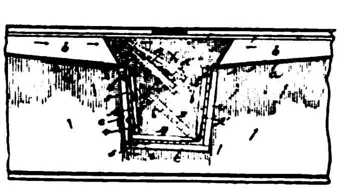
Claim.—1. The combination with the runners and the horizontal shaft journaled in vertically movable connected bearings and carrying spurred wheels and a bevel pinion, a vertical shaft having a crank handle and carrying a bevel pinion meshing with the said pinion and a cam shaft connected with said bearings and provided with a lever for moving the horizontal shaft vertically, substantially as and for the purpose specified.



REFRIGERATOR CAR.

No. 509,807. Charles S. Hardy, San Diego, Cal. Filed May 15, 1893. Serial No. 474,252. Patented November 28, 1893. (No model.)

Claim.—1. The combination, with a refrigerating chamber, of the foldable ice box sections and means substantially as described which suspend and flexibly but permanently connect such sections, whereby they are adapted to fold and unfold in the manner specified.



3. The combination, with a refrigerating chamber, of the folding ice box sections, hinge connections for two of said sections, and the flexible, or jointed, yet permanent connections composed of the series of aligned and jointed plates which are attached to a side and a floor section and the ceiling whereby the said sections are caused to fold and lie parallel, as shown and described.

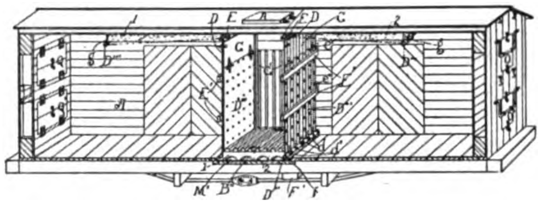
(4)

REFRIGERATOR CAR.

No. 509,836. Perd. A. Barker and Fred A. Reynolds, Los Angeles, assignors to Charles Saunders Hardy, San Diego, Cal. Filed December 12, 1892. Serial No. 454,812. Patented November 28, 1893. (No model.)

Claim.—1. A refrigerator having an ice box formed with a partition hinged to fold against the inside of the car and an ice rack hinged to fold against said partition substantially as set forth.

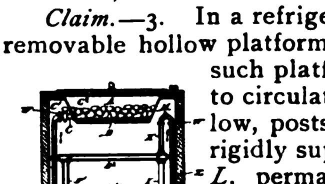
2. A refrigerator car having removable partitions hinged to the car to form an ice box when unfolded and adapted and arranged to fold against the inside of the car out of the way of ordinary cargoes when not in use as an ice box; a removable ice rack arranged to support the ice in the box and hinged to the bottom of one of the removable partitions and arranged to be folded between the partition and the side of the car when not in use as an ice rack.



COMPRESSION PUMP FOR REFRIGERATING APPARATUS.

No. 507,025. Stephen S. Miles and Casper W. Miles, Cincinnati, Ohio, assignors of one-third to Lemuel Wood, same place. Filed January 27, 1892. Serial No. 419,460. Patented October 17, 1893. (No model.)

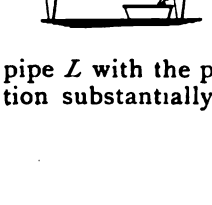
Claim.—In a refrigerating machine, the combination of the open-mouthed pump cylinders *A*, intake valves 2 located at the closed end of said cylinders, water jacket *N* inclosing said cylinders, reciprocating plungers 5, exit valves 6 located in the plungers and a liquid lubricant chamber *G* inclosing the open ends of said cylinders substantially as specified.



REFRIGERATOR.

No. 510,192. Theodor Schoppe, Bonn, Germany. Filed March 15, 1893. Serial No. 466,152. Patented December 5, 1893. (No model.) Patented in Germany July 23, 1892. No. 67,546.

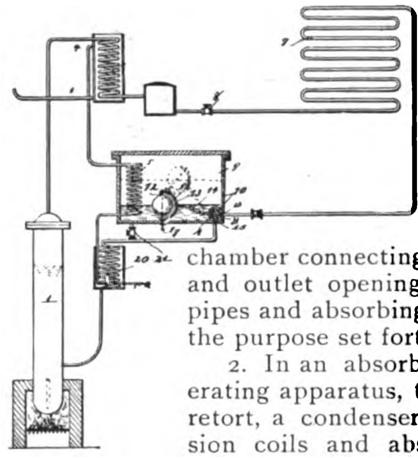
Claim.—3. In a refrigerator, a series of two or more removable hollow platforms *D D'*, pipes *F F*, uniting such platforms, and allowing the water to circulate through the same from below, posts *I I*, aiding to connect and rigidly support the platforms, pipes *E L*, permanently connected, one with the removable platforms and the other with the stationary casing of the refrigerator, the detachable joint *W* connecting the pipe *E* with the pipe *C* and the detachable joint *H* connecting the pipe *L* with the platforms, all arranged for joint operation substantially as herein specified.



REFRIGERATING APPARATUS.

No. 507,729. Carl C. Gerlach, Cleveland, Ohio. Filed December 14, 1892. Serial No. 455,150. Patented October 31, 1893. (No model.)

Claim.—1. In an absorbent refrigerating apparatus, the combination of a retort, a condenser, a receiver, expansion coils and an absorbing chamber, pipes connecting the several parts in a continuous circuit and a float and two-way valve in the absorbing chamber connecting alternately the inlet and outlet openings in the circulation pipes and absorbing chamber as and for the purpose set forth.

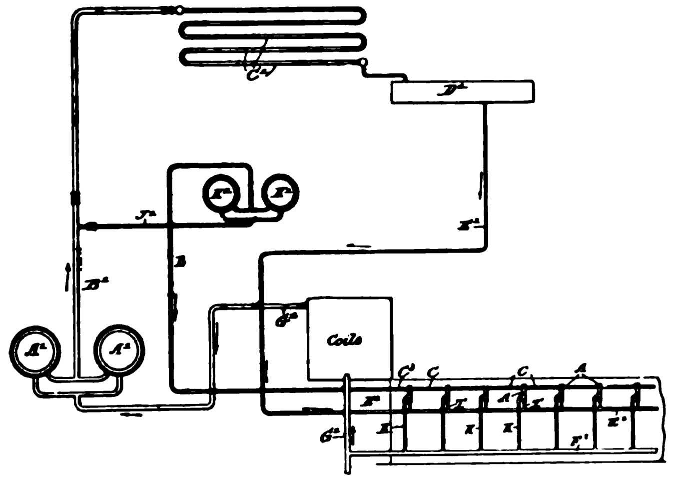


2. In an absorbent ammonia refrigerating apparatus, the combination of a retort, a condenser, a receiver, expansion coils and absorbing chamber, in combination with circulation pipes connecting the several parts, and float and two-way valve in the absorbing chamber connecting with said pipes, whereby the pressure in the retort and absorbing chamber may be equalized and the circulation of gas and liquid regulated automatically, substantially as described.

REFRIGERATING MACHINE.

No. 508,141. John Levey, Thomas H. Butler and Charles A. MacDonald, Chicago, Ill., assignors to the Hercules Iron Works, same place. Filed November 16, 1892. Serial No. 452,209. Patented November 7, 1893. (No model.)

Claim. 1. In an apparatus for the production of ice, the combination of a compressor, liquefier, expansion

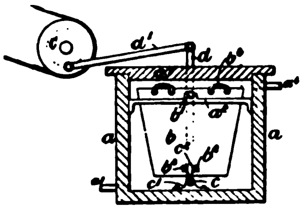


coils or chamber, with pipes connecting them in series and a pipe leading from between the compressor and the liquefier to a point between the compressor and the expansion coils and a re-compressor or supplementary compressor in such latter pipe for the purpose of heating the expansion pipes so as to release the ice therefrom.

MANUFACTURE OF ICE AND APPARATUS THEREFOR.

No. 507,005. Frederick B. Hill, London, England, assignor to the Hills Cold Storage Co., Limited, same place. Filed June 9, 1892. Serial No. 436,163. (No model.) Patented in England November 11, 1889, No. 17,973.

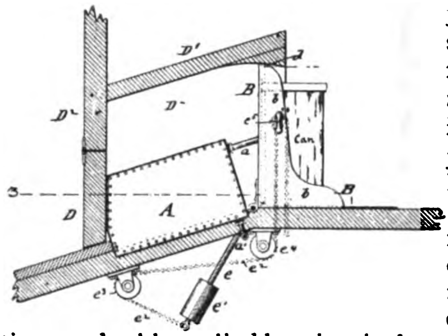
Claim.—In an apparatus for the production of ice, the combination of a tank *a* through which a non-congealable liquid is circulated, elongated pans or receptacles *b* for the liquid to be frozen, arranged within the said tank and mounted upon trunnions or pivots b', the axes of which extend transversely to the said pans, studs or projections b^2 on the said pans, a rock shaft *c* mounted in bearings in the said tank and provided with an arm c^2 to engage with the said studs or projections, and means for rocking the said rock shaft, substantially as and for the purpose described.



APPARATUS FOR REMOVING CAKES OF ICE FROM FREEZING CANS.

No. 508,145. Henry Mock, New York, N. Y. Filed June 19, 1893. Serial No. 477,908. Patented Nov. 7, 1893. (No model.)

Claim.—1. An apparatus for removing cakes of ice from freezing cans, consisting of a double walled heating jacket and a can-supporting platform adapted to be moved with the can into or out of the jacket, substantially as set forth.



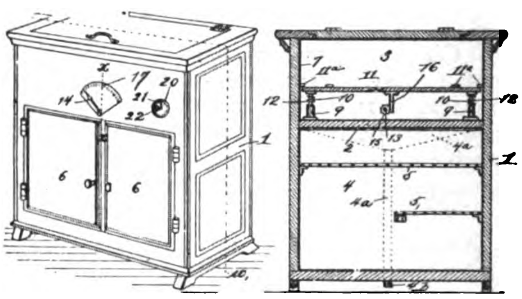
2. An apparatus for removing cakes of ice from freezing cans, which consists of a stationary double-walled heating jacket open at the top and ends, and a platform hinged at or near one end of the jacket and adapted to be tilted into the same, substantially as set forth.

3. The combination, of a stationary double-walled jacket open at the top and sides and provided with means for supplying exhaust steam to the same, a tilting platform hinged at or near one end of the jacket, and means for lowering or raising the platform into or out of the jacket, substantially as set forth.

WEIGHING AND REGISTERING ATTACHMENT FOR REFRIGERATORS.

No. 508,507. William B. Dickson, Kansas City, Mo. Filed May 1, 1893. Serial No. 472,501. (No model.)

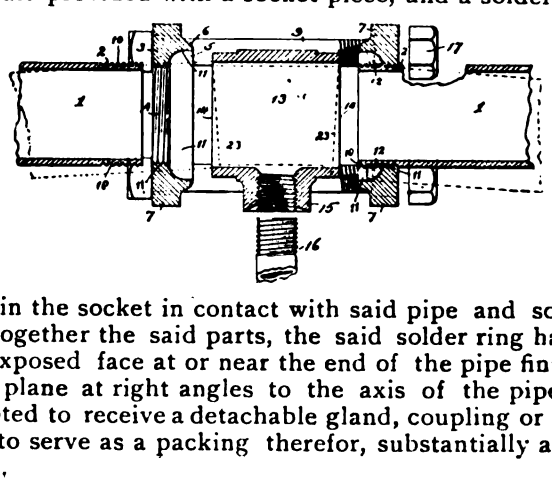
Claim.—A refrigerator, having an ice chamber, a movable platform mounted therein, and a revoluble shaft 13 having an arm, and located in the said chamber, and adapted to be actuated by the movable platform, in combination with a ratchet wheel having a stub shaft journaled in a side wall of the refrigerator, and also having a tubular socket in which is revolubly mounted on end of the shaft 13, a dial plate upon the outer side of the refrigerator, an index finger carried by the outer end of the stub shaft, and a spring-actuated pawl carried by the arm of the shaft 13, and engaging the ratchet wheel, substantially as set forth.



GAS TIGHT JOINT FOR REFRIGERATING APPARATUS.

No. 507,040. Hermann Rassbach, Washington, D. C. Filed April 22, 1893. Serial No. 471,462. Patented October 17, 1893. (No model.)

Claim.—1. In a joint the combination of a pipe or conduit provided with a socket piece, and a solder ring



cast in the socket in contact with said pipe and soldering together the said parts, the said solder ring having an exposed face at or near the end of the pipe finished to a plane at right angles to the axis of the pipe and adapted to receive a detachable gland, coupling or pipe, and to serve as a packing therefor, substantially as set forth.

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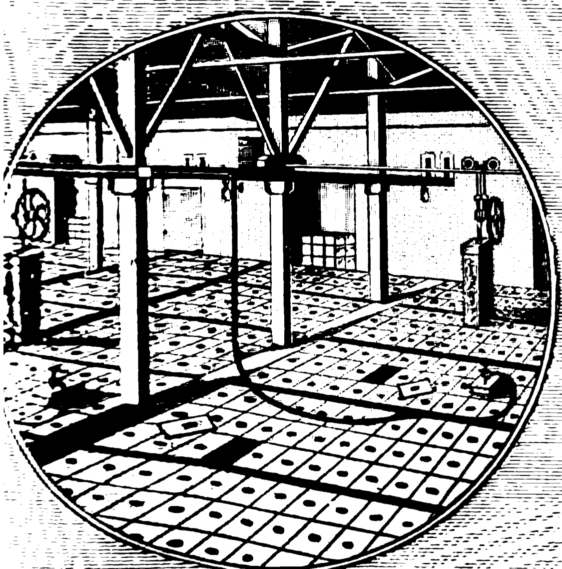
February, 1894.

Ice and Refrigeration Illustrated



H. S. Rich & Co. Publishers

Chicago & New York.

ICE AND REFRIGERATION ILLUSTRATED

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

VOL. VI. NO. 2. CHICAGO : NEW YORK : FEBRUARY : 1894. $2.00 PER ANNUM.

[*Written for* ICE AND REFRIGERATION.]

A CHICAGO PLANT.

PREMISES OF THE CONSUMERS PURE ICE CO.—THE MACHINERY IN USE—SYSTEM OF MAKING DISTILLED WATER—THE NEW COLD STORAGE HOUSE.

A. B. DEWEY, PRESIDENT.

THE plant of the Consumers Pure Ice Co., at Thirty-fifth and Butler streets, Chicago, is the largest ice making plant in the United States and one of the largest in the world, having a daily capacity of 240 tons of ice. Without being in any sense a "fancy" plant, it is nevertheless one of the most complete and best appointed ice factories in the country, upon the perfection of which no expense has been spared by its owners when expenditure was likely to improve the quality of its products. The company was organized in February, 1890, with a capital stock of $250,000. A plant was erected the same year with a daily capacity of 120 tons of ice, the machinery being two 60-ton "Consolidated" machines, built by the old Consolidated Ice Machine Co., since succeeded by John Featherstone's Sons, Chicago. The business was fairly successful, and in the spring of 1892 the capacity of the plant was doubled by the addition of two 60-ton absorption machines built by the Southern Ice Machine Co., of Chattanooga, Tenn., since gone into liquidation. In 1893 the cold storage department was added, the house having opened for business in September last. This, in brief, is the history of the company as it "appears of record"; but of the disappointments with first results, the expenditure of thought and money necessary to bring the original plant to its present condition, of the great expense of unforeseen changes that had to be made, as well as the cost of the additions of machinery, materials, etc., that have become fixed capital, this record can say but little; but the truth may be hinted at when it is stated that the premises as they stand to-day represent an investment of something over $600,000.

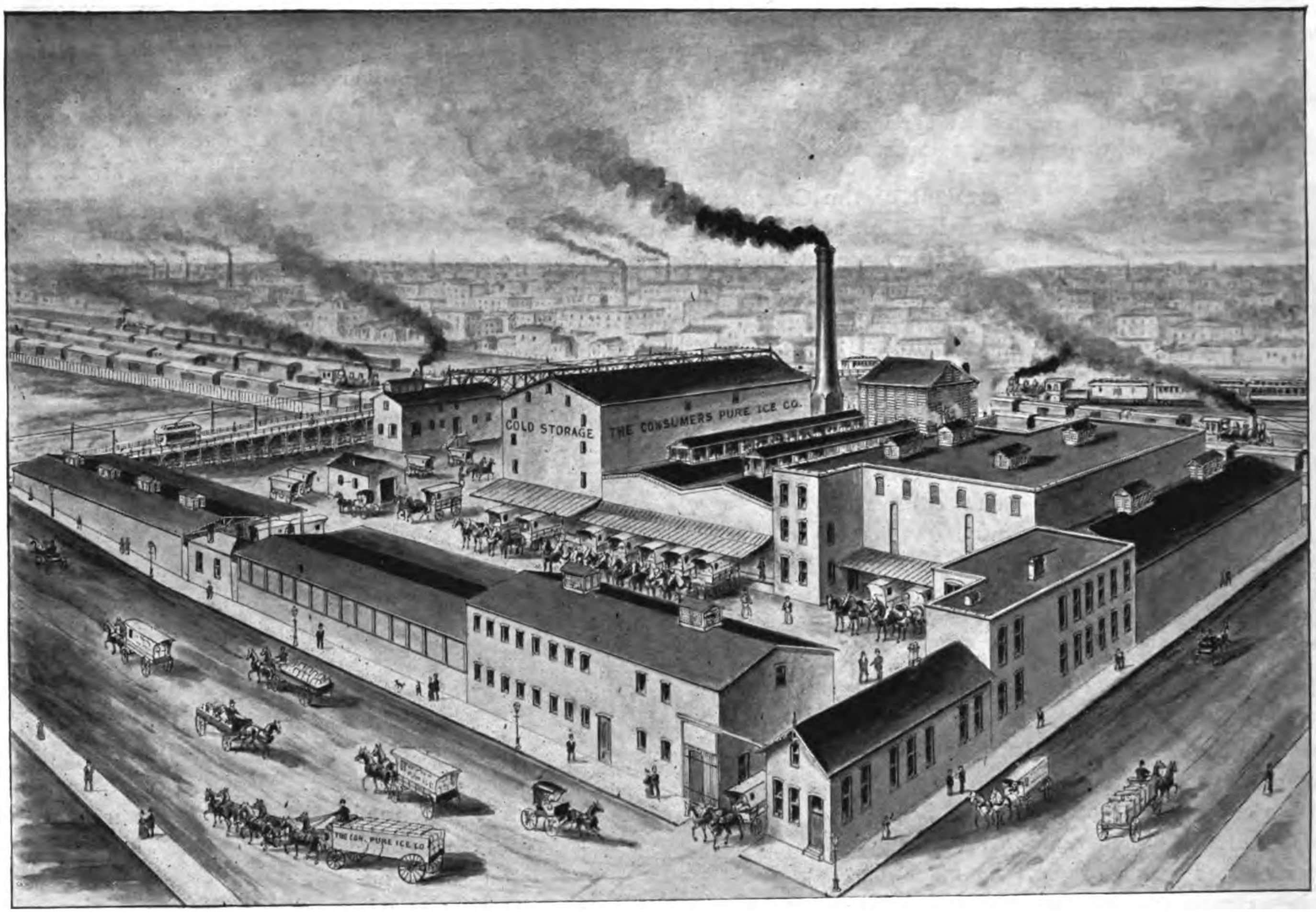
F. L. JEWETT, SEC'Y.

The company has always been well managed, and there have been but very few changes in its list of officers since the formation of the company. Mr. E. H. Turner was the first active president. He was succeeded by Mr. F. G. Kammerer, now a director; and Mr. Wm. Moseback was formerly secretary and treasurer; otherwise there has been little or no change in the official staff. The present officers are as follows: A. B. Dewey, president; E. E. Maxwell, vice-president; C. P. Dewey, treasurer; F. L. Jewett, secretary; F. W. Mehlhop is manager of the cold storage department, and C. B. Fair is responsible for the mechanical department of the business. The stockholders are all prominent and wealthy Chicago people. The Messrs. Dewey, of the official staff, are capitalists, and Mr. Maxwell a member of the firm of S. A. Maxwell & Co. Mr. Mehlhop is a native of Dubuque, Iowa, and has been in the cold storage business for a number of years.

The architectural appearance of the plant of the Consumers Pure Ice Co. is decidedly utilitarian. Located in a utilitarian neighborhood, with the railway tracks of the half dozen roads entering Chicago *via* the Western Indiana "Belt Line" adjoining the premises on the east, a switch from these tracks entering the yards of the company, the plant has exceptional facilities for procuring cheap fuel, the soft coal "slack," which when handled by an intelligent and careful fireman makes the cheapest fuel obtainable in Chicago; and it has been found by actual and carefully recorded trial in this plant to be cheaper than crude oil, a 500-barrel storage tank and outfit for burning

C. P. DEWEY, TREASURER.

which has been abandoned for slack coal. The brick work, too, is run up with Chicago "mud" brick, than which it would be difficult to find a more "disreputable" looking "slug," though it is an exceptionally strong and durable brick. Furthermore, the stables for the horses and sheds for the ninety wagons of the company line the Butler street front, filling the west side of a hollow oblong square, the south end of which is closed by the two office buildings, and on the east side of which stands the plant itself. The ice storage building stands on the south end of the area, next to which is the machinery room with the tanks of the compression system and then the cold storage house, the first floor containing the tanks of the absorption system, above which latter section of the building are ranged the three stories of the cold storage department. It is not a "beauty spot," perhaps; yet it is a decidedly interesting place and a very busy corner of Chicago industry; while to Chicago housewives there is probably no single address better known than this company's "Thirty-fifth and Butler." This explanation will make clear the bird's eye view herewith.



CONSUMERS PURE ICE CO., CHICAGO—BIRD'S-EYE VIEW OF THE PREMISES, LOOKING NORTHEAST.

Our interior views show the absorption and compression sections of the plant, and also those two types of machines. There is nothing here that is materially different from the arrangement of such plants elsewhere. The ice is drawn from cans by means of a pneumatic air hoist, one hoist to each of the eight sections of the tanks. A 65-horse power Whitehill horizontal engine is used to move the eight rotary brine circulating pumps of the types made by the Morris Machine Works, Baldwinsville, N. Y., and by the Laidlaw-Dunn-Gordon Co., Cincinnati. The absorption system is equipped with two 14×6½×12-inch ammonia pumps, built by the Dean Bros. Steam Pump Works, Indianapolis. The ice cans were made by the Kiechler Mfg. Co., Cincinnati.

E. E. MAXWELL, VICE-PRESIDENT.

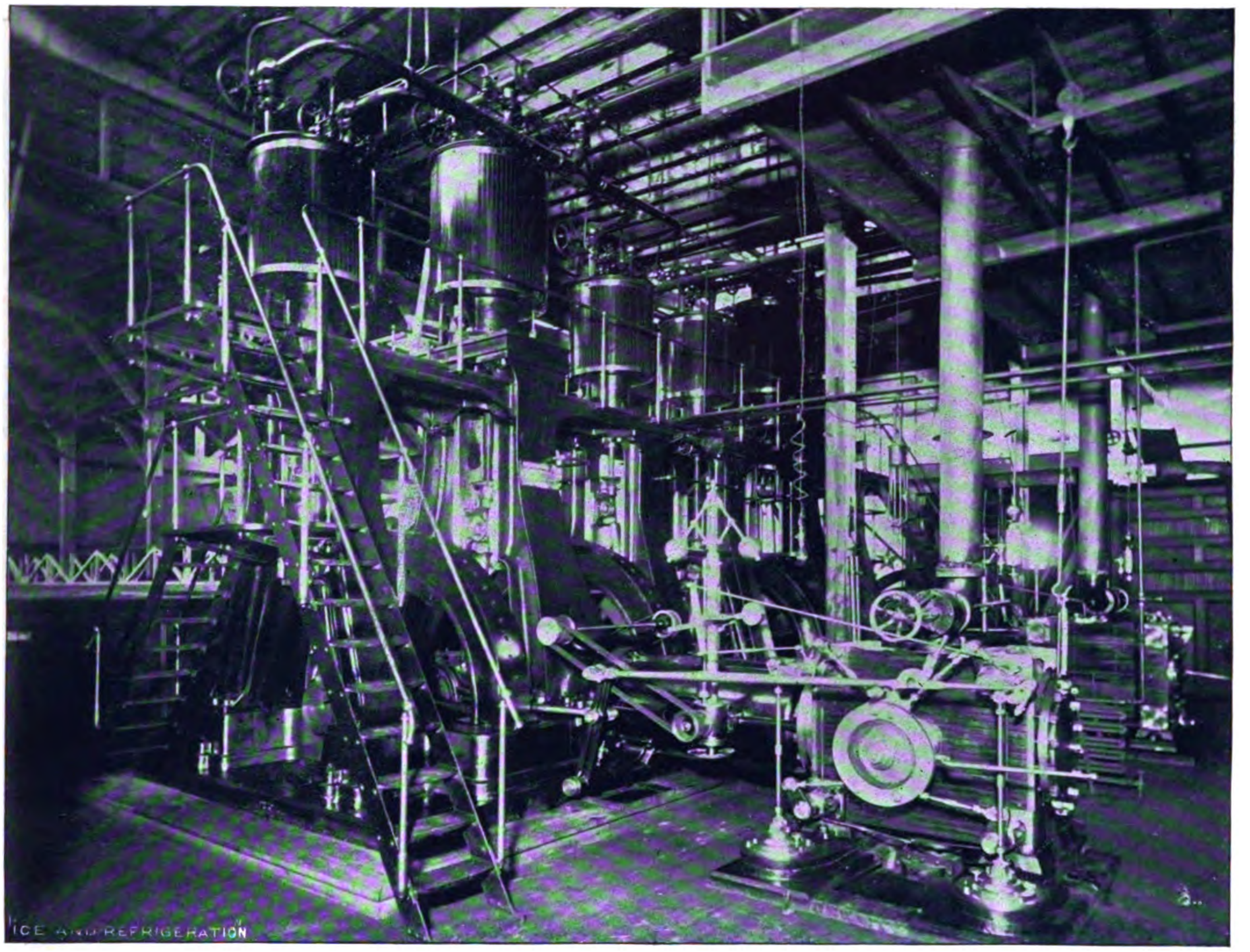
In the same section of the building, near the compression plant is the electrical plant, consisting of one 50 horse power New York Safety Steam Power Co. horizontal high speed engine (Milton Thomas, agent, 60 So. Canal st., Chicago), operating two Edison dynamos, one of 150 and one of 500 incandescent lights and one "Standard" 25-light (arc) dynamo. These three outfits light every part of the plant, including the cold storage department, which is exceptionally well lighted. A photograph of this plant also appears among our illustrations.

Immediately between the two ice making systems the company have placed a convenient and valuable adjunct to a plant of this size and character; that is, a small machine shop for pipe fitting and making the repairs necessary around the premises. The machinery outfit is modest, but it answers the purpose, and has saved its cost repeatedly. It consists of one 24×12 bed lathe (Blaisdell & Co., Worcester, N. Y.), one pipe threading machine making cuts up to six inches (Biguel & Kitter, St. Louis), and one 24-inch drill press (Barnes), with accessory tools. With this outfit they have prepared practically all the piping used to fit up 500,000 cubic feet of cold storage, and the work has been well done.

The boiler house is in two batteries—one of four

McGeary & Dunn and one of five Porter Boiler Works Co. boilers, each 72 in. × 9 ft., equal to 100-horse power each. One of these batteries is shown among the illustrations. Two Knowles and one Laidlaw-Dunn-Gordon boiler feeders are used, and one 550-horse power feed water heater made by Wm. Baragwanath & Son, Chicago.

The fire protection of the plant is well arranged, consisting of stand pipes reaching every part of the building from top to bottom, with frequent fire plugs for hose attachment for use of hose on reels, while a Laidlaw-Dunn-Gordon fire pump stands in the engine room ready for instant use. In addition, there are about thirty stations in and about the grounds and buildings, each of which records the stages of the watchman's half-hourly trips through the premises, the device used being an automatic eco-magneto clock, by the Eco-Magneto Clock Co., Boston, which makes a full record of the watchman's performance of his duty.



CONSUMERS PURE ICE CO., CHICAGO—INTERIOR VIEW OF ENGINE ROOM, SHOWING COMPRESSION MACHINES.

MAKING DISTILLED WATER.

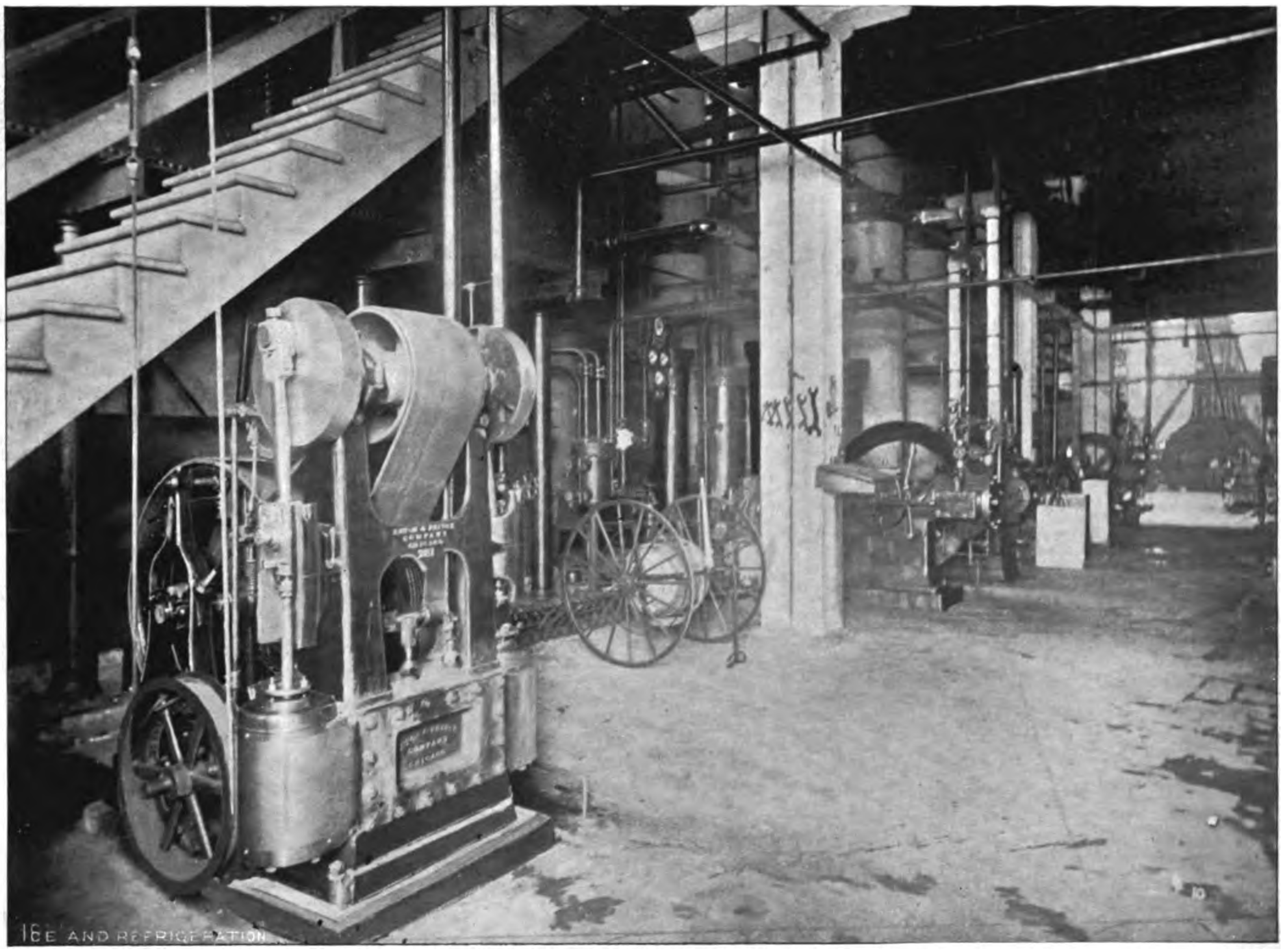
The most interesting feature of this plant is the method of distilling and handling water for ice making and for the table, the latter known throughout the city as the "Hydrox" water, the sale of which has rarely fallen under 500 gallons in any one day, and has exceeded 2,000 gallons per day, the daily sales varying with the season quite as much as does the sale of ice, although the daily average of water sold is rapidly getting to be larger from quarter to quarter. This water is put up for the trade in five-gallon glass bottles, and in half-gallon bottles, delivered in crates of one dozen bottles. The five-gallon bottles are also protected by crates. Both sizes of bottles are stoppered by steamed corks, and sealed with a trade mark paper seal. The bottles were made by the Streator Bottle and Glass Co., Streator, Ill. Although the retail price for the half-gallon packages is slightly greater per gallon than for the five-gallon bottles, the former are rapidly becoming the more popular, being more convenient, one bottle being of sufficient size for the dining room or butler's pantry refrigerator, and ample in most cases for one meal of the family, in which case no water is left over to be spoiled by the carelessness of servants who too frequently let both the large and small bottles stand in the refrigerator uncorked, to absorb all the vapors of that much abused piece of furniture. For handling the five-gallon bottles, F. G. Kammerer & Co., 518 The Rookery, Chicago, make a convenient tipping holder, as shown on page 119. It is made of iron, holds the bottle securely, and rights itself automatically after drawing water, thus preventing all waste by carelessness.

The company takes especial care of their distilling process and apparatus, believing that therein is one of the secrets of successful ice making. It is impossible to freeze clean, clear, coreless ice if the water to be frozen is impure or dirty. For distilling water for ice, therefore, live steam is drawn direct from the large battery of boilers for this purpose. From the boilers this steam passes first through (1) an atmospheric condenser, from which it passes (2) at boiling point to a hot filter charged with animal charcoal. It is then (3) passed to a re-boiler

and brought to a temperature of 215°, whence it passes (4) to another hot filter charged with layers crushed (pulverized) quartz and animal charcoal. It is then (5) again re-boiled at 212°, and passed on (6) to the cooling coil and the temperature reduced to 50°; thence it passes through (7) (8) two filters charged with maple charcoal, from which it is run (9) into the storage tank. On the way from this tank to the freezing cans it passes again (10) through the final filter charged with crushed quartz and maple charcoal, in layers six inches thick separated by silk cloth. The care of the water, it will be seen, is almost excessive, but the results of the freezing amply justify all this extraordinary care in the production of ice never stained by impurities, and practically free from core.

The "Hydrox," or "bottle," water is re-distilled in an entirely separate and distinct system, and the steam passes (5) through a second hot filter of maple charcoal and quartz with layers separated by silk and cheesecloth, from which filter the water is carried (6) to the cooling coil, and the temperature reduced to 54°. It is then run (7) through a filter of charcoal and quartz, and passed (8) to the storage tank, which is connected with a (9) cold filter in the bottling room, from which the water is drawn direct to the glass bottles (5-gallon and ½-gallon), the bottles having been previously washed with boiling water and rinsed with distilled water.

This filtering system is the company's own design, one distinguishing feature of which is the entire absence of galvanized iron in the piping or filters. For the former the best black iron pipe only is used, while all the filters, originally of galvanized iron, have been coated with an enamel impervious to the attack of any

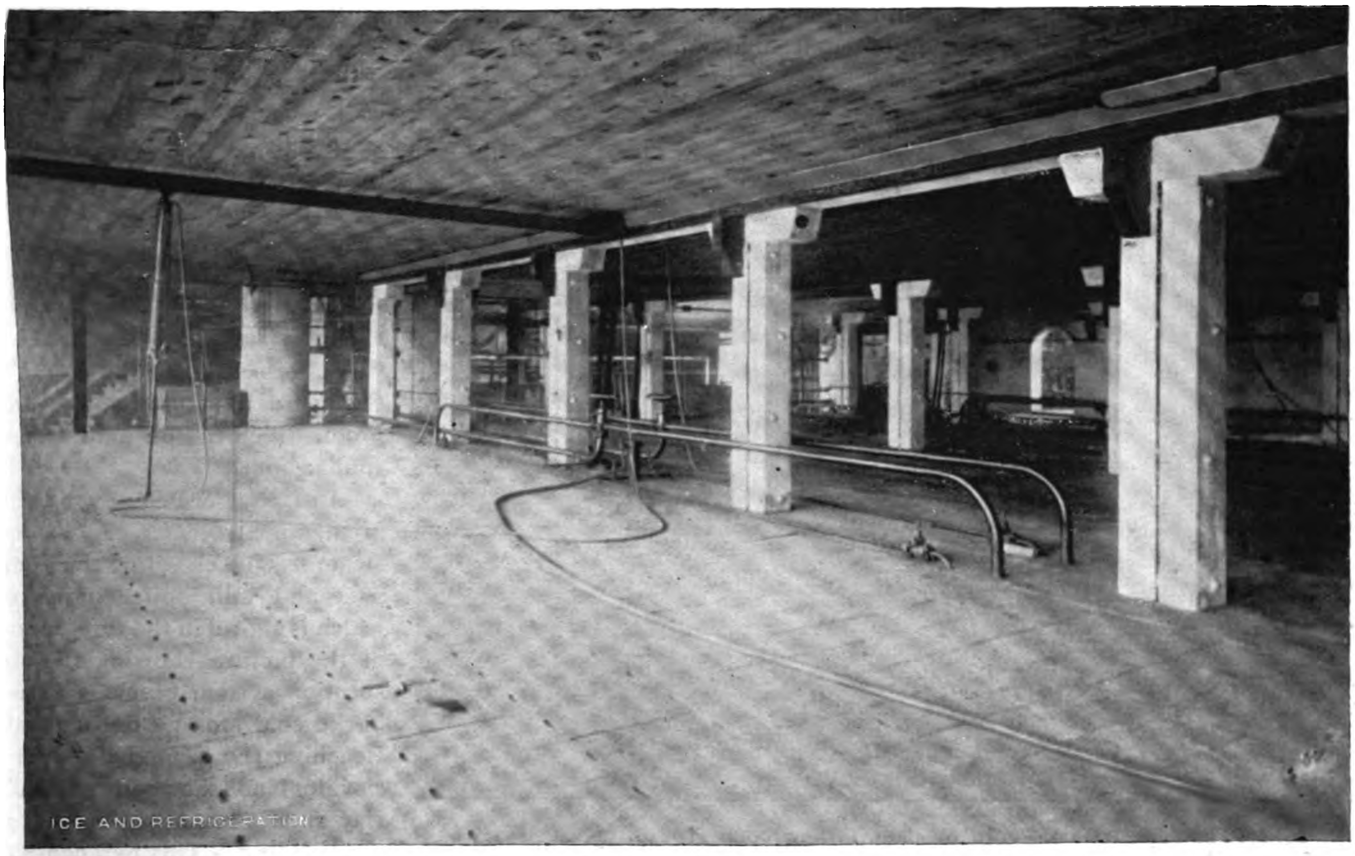


CONSUMERS PURE ICE CO.—INTERIOR VIEW SHOWING ABSORPTION MACHINES, ALSO EATON & PRINCE ELEVATOR.

substances or solvents common to or likely to be found in water. The average engineer of an ice factory would doubtless object to the use of black iron pipe, because, he would say, it develops rust and stains the ice; but Mr. Fair's experience is evidence that this is not necessarily the case if care be taken to keep the pipes clean. This is done by blowing out all the piping once every twelve hours. While the steam is still on, filling the pipes, the exhaust valve is closed, leaving the pipes full of steam. When this is condensed a vacuum is formed. No air, therefore, enters the pipes, and they are always clean. On the other hand, by the use of iron pipe all possibility of contamination of the water by forms of zinc in solution developed by the galvanized pipes is obviated. This is not so undesirable a feature

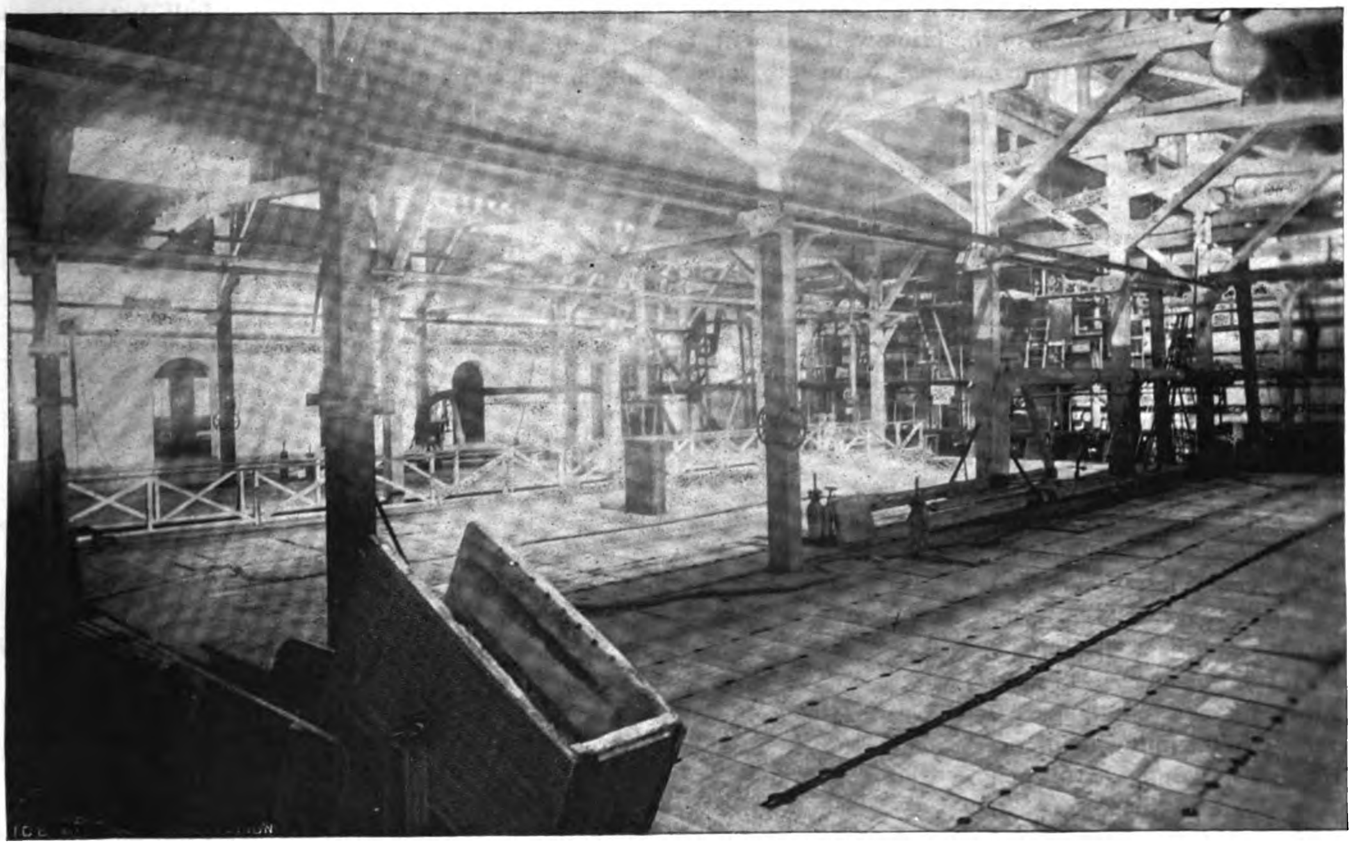
or waters of the two systems never come together again after passing out of the original boiler. In this system also the steam is taken (1) as dry as possible from the highest point of the steam dome, and passed (2) to the atmospheric condenser, and thence (3) to the hot filter charged with crushed quartz and maple charcoal (no animal charcoal being used in this system) in 6-inch layers. The water is then (4) reboiled at 220°. At the top of this reboiler is a 5-inch vapor pipe, which is carried from the reboiler up and out through the roof of the building, a device invented by Mr. C. B. Fair, the engineer. Its form and height create a strong draft, as through a chimney, from the surface of the boiling water, and carries away from the water all traces of the gases developed by the re-boiling. The water then

as might at first be thought, for the company has demonstrated that distilled water, standing for any length of time in galvanized receptacles, has a marked tendency



CONSUMERS PURE ICE CO., CHICAGO—INTERIOR VIEW SHOWING FREEZING TANK OF ABSORPTION SYSTEM.

to develop the oxides of zinc, and has also a remarkable affinity for them. This is one substantial reason for the



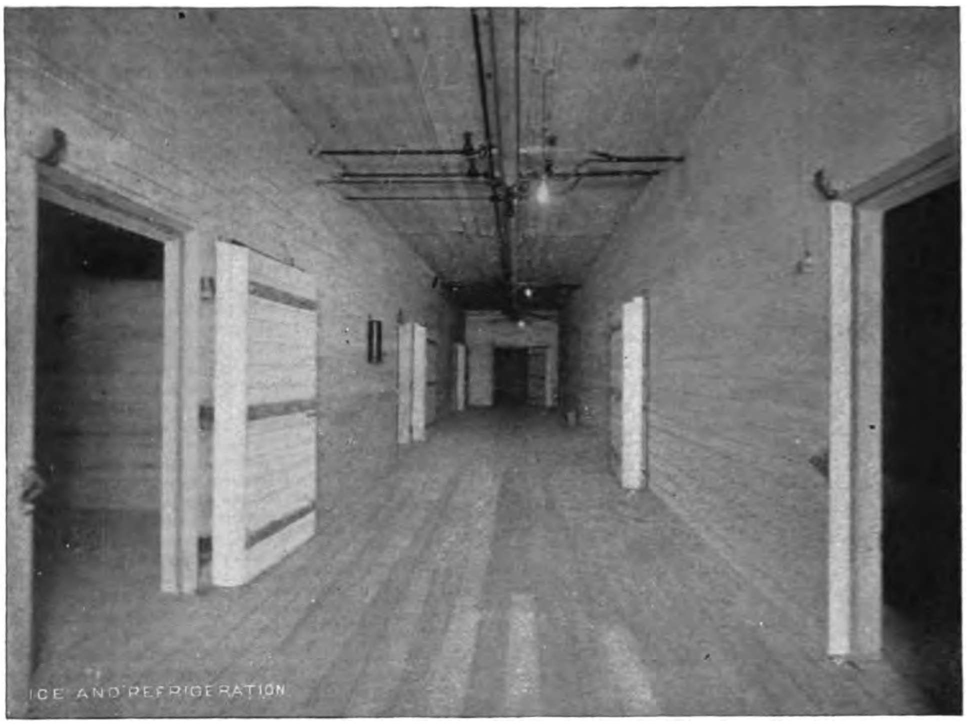
CONSUMERS PURE ICE CO., CHICAGO—INTERIOR VIEW SHOWING FREEZING TANK OF COMPRESSION SYSTEM.

use of glass water bottles instead of galvanized iron cans, the use of which was abandoned after a thorough trial.

ICE STORAGE.

The trade will be interested in the fact that this plant has two ice storage houses with a capacity of 6,000 tons of ice. These buildings have brick walls, and are insulated and piped for brine circulation, the temperature being held at 28°. Each building is divided into three sections, the partitions being built of 2×8 timbers covered

with "P. & B." paper, and spaces filled with planer shavings. The refrigerating coils hang under the ceiling, and are in sections, each section having its separate feed, so that as much or as little refrigeration can be used as may be needed. The ice, which is frozen with brine tank at 14° to 16° F., is run into these rooms direct from the tank. Each layer of ice is separated from that below it by ½-inch strips of wood, and on sides and ends each block is separated and isolated from its neighbor. This system has been found perfectly satisfactory, and no ice has been lost. The entrances are in usual ice house form, running from top to bottom of the brick wall on the west side of the storehouse, these openings being protected by a second wall enclosing the driveway for loading wagons.



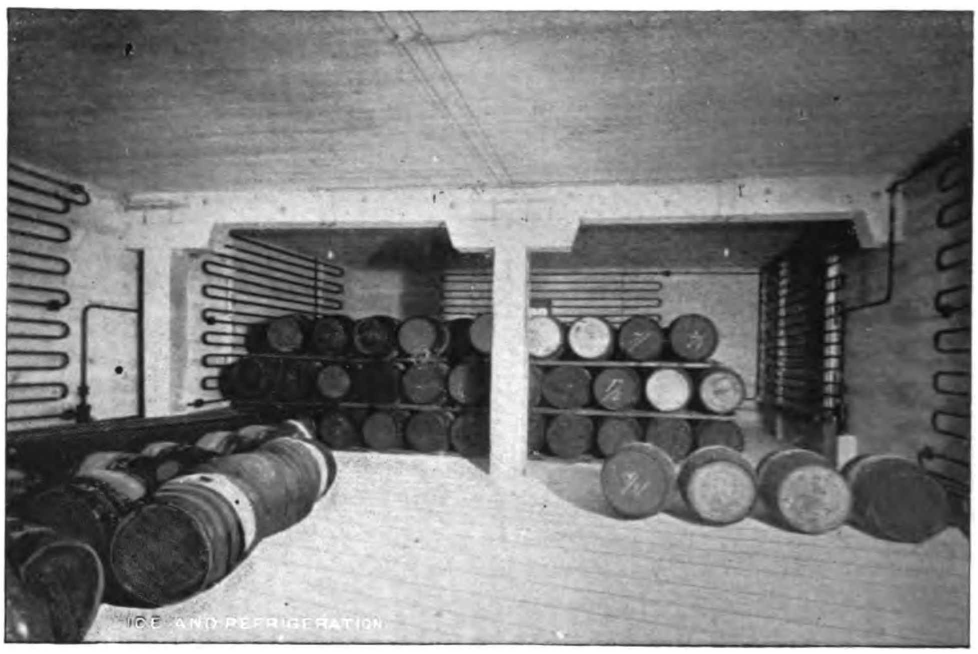
CONSUMERS PURE ICE CO.—VIEW OF HALL IN NEW COLD STORAGE DEPARTMENT.

COLD STORAGE DEPARTMENT.

The cold storage department, which was added last summer, having been opened for business in September last, is built in part over the ice tank of the absorption system, and is four stories high. The plans and specifications were prepared by Wm. T. Lesher, architect, at suite 128, 185 Dearborn street, Chicago, under whose direction the building contracts were let. The exterior walls are brick, with insulating interior wall linings. This insulation consists of mineral wool, paper and air spaces, arranged in the following order: Brick wall, painted; 1×2-inch strips, sixteen inches apart, forming air spaces; one thickness of P. & B. paper; ⅞-inch matched stuff; P. & B. paper; 2×2-inch stuff, cutting this section into 12-inch squares filled with mineral wool, the use of square spaces preventing any possible settling of the mineral wool; paper; ⅞-inch matched stuff; paper, 1×2-inch stuff, as above; paper; matched stuff. All partitions are similarly built, using ⅞-inch matched stuff where brick appears as the exterior wall. One marked feature of this well planned house consists in the fact that from its very form of construction it is absolutely rat proof, which can be said of few similar houses.

F. W. MEHLHOP,
Supt. Cold Storage Department.

An Eaton & Prince (70 to 76 Michigan Street, Chicago) 2-ton steam freight elevator, the compact and well built engine of which is shown in the foreground of the picture showing the absorption system plant, is in use in the cold storage department. Reaching the second floor, this elevator lands the visitor at a hallway running across the end of the building. This hall consists of a landing and hall, the hall being a sort of buffer for the outside heat and that from the elevator shaft, the landing being cut off from the hall by insulated wall with door. From this first hall, in the center of the building on each of the three floors a second hall, perpendicular to the first, runs lengthwise of the building. These halls are specially piped and are uniformly held at 12°.



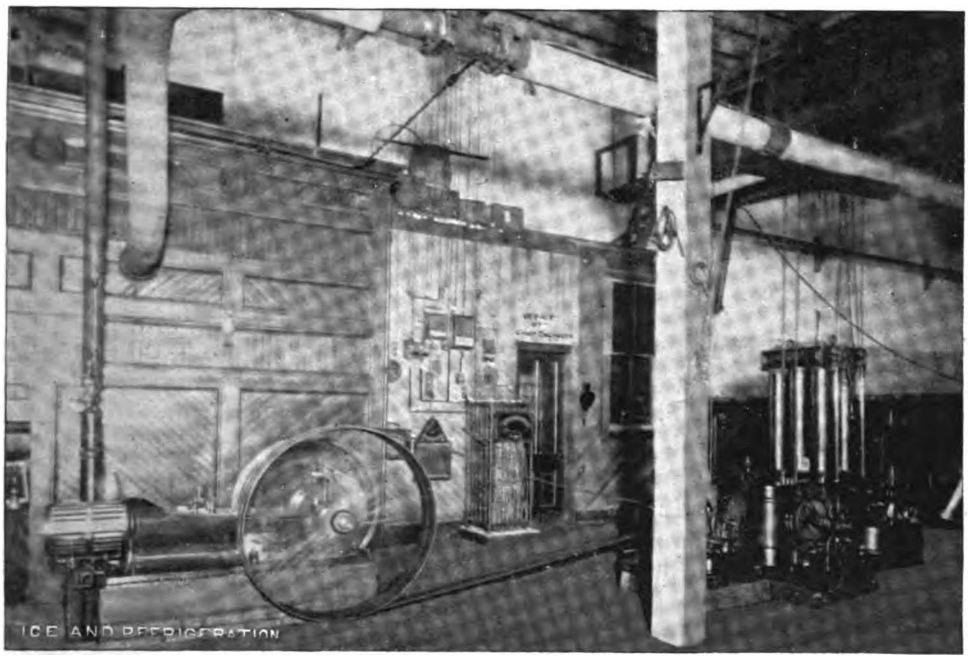
CONSUMERS PURE ICE CO.—INTERIOR VIEW OF ROOM IN COLD STORAGE DEPARTMENT.

On both sides of these halls are arranged the cold rooms, twenty-seven in all, of various sizes, which are held at from below 0° up to 32° and above as required. Four rooms entered the other day showed temperatures

of 0°, —4°, —8° and —9° respectively. The rooms are remarkably dry, some of them, in use since September last, showing a gathering of frost in the expansion piping of only a small fraction of an inch, though none had been cleaned since put in use. The feeds to the rooms of each floor are all placed in the halls and accessible without entering any room at all. The piping in each room is extra liberal, and in consequence the fall in temperature responds promptly to the circulation of the gas when all the coils are in use; but each section is so far independent of the others in the same room that each may be cut off from the others, reducing the pipe surface or enlarging it as the requirements of the service call for. The piping has all been tested by air pressure up to 500 pounds per square inch; while the main feed is connected up with each separate machine of the four in use in the engine room, so that a "break down" is practically impossible. A small window in each room is so constructed as to permit a free entrance of outside air for extra ventilation over and above that obtained through the halls by the opening of doors; but this precaution has not yet been used, since rooms that are as dry as these have really very little need for ventilation. Wet rooms require a change of air more often than dry ones.

CONSUMERS PURE ICE CO.—VIEW OF DISTILLED WATER BOTTLING ROOM.

This cold storage, though not as large as some others in the city, is really one of the best open to the Chicago public, being available for every purpose for which cold storage is utilized, from the care of fruit, poultry, butter, etc., to quick freezing. The house lies directly alongside the tracks of several roads and *via* the "Belt Line" and its own private switch is accessible to all.



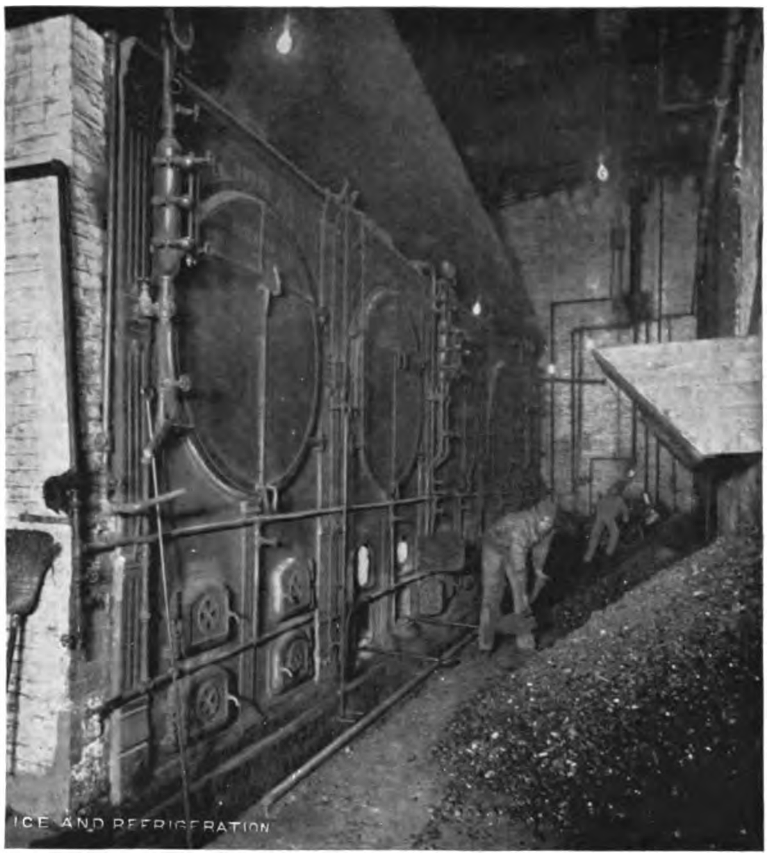
VIEW OF ELECTRICAL PLANT, WITH N. Y. SAFETY STEAM POWER CO. ENGINE.

The company, besides, is exceptionally well equipped with ample rolling stock to meet every demand of their trade. Mr. Mehlhop, the superintendent of the department, is a young man of extensive experience, both in building and in operating cold storage plants, and though the house has been open for business for only five months, he has already built up a quite satisfactory business.

In the retail ice department, the company uses the coupon ticket system, as the most satisfactory system for handling small accounts. The system is in use also in the wholesale department of the business for all its trade up to ton lots, above which weights at single deliveries a ticket is used which in duplicate records the weight of ice delivered. This system has been found very generally satisfactory, and particularly so in its application to the requirements of the family trade accounts. It is to this trade that the Consumers Pure Ice Company especially gives its attention, and the use of the coupon has reduced to a minimum the usual unreasoning complaints of the trade, since the driver must deliver ice in order to get his coupon (or pay), which, in its turn, becomes a handy medium for settling his accounts at the office. The care which the company devotes to the handling


C. B. FAIR, CHIEF ENGINEER.

of its family trade has developed one feature of business detail which is, so far as we know, entirely unique with them. This is the establishment of a permanent restaurant on the premises, where the delivery employes are breakfasted, and may obtain other meals. The "ice man" is an "early bird," summer or winter, and he is the exception among the large number of hands who man the wagons of a company like this who is able to breakfast before he is due at the loading platforms. In consequence, nearly all of them start out from the factory hungry; and it is understood by many companies that they may carry away ice enough to get breakfast with, which ice in fact disappears at the favorite saloon in exchange for a bad substitute for a breakfast; *i. e.*, for liquor and crackers—worse than nothing, in fact. The Consumers company changed all this by establishing a restaurant, where, after the men have loaded their wagons, they get their breakfast. Having thus started out from the works sober and in good condition, they stay sober all day; and the Consumers company have had (in the year or more since they adopted this plan) only two cases of drunkenness, and those men were discharged "without grace." The wagon men of this company, furthermore, by this kind of treatment and requirement by the company, are clean, self-respecting, well behaved, and their visits, even as men merely, are welcomed rather than shunned by the housewife who too often associates "the ice man" with an alcoholic breath and general unkemptness and uncleanliness. Few investments made by the company have yielded a bigger dividend, in satisfaction, at least, than this restaurant, which is so good that the officers and office employes lunch there, especially during the winter months.



CONSUMERS PURE ICE CO.—SECTION OF ENGINE ROOM.

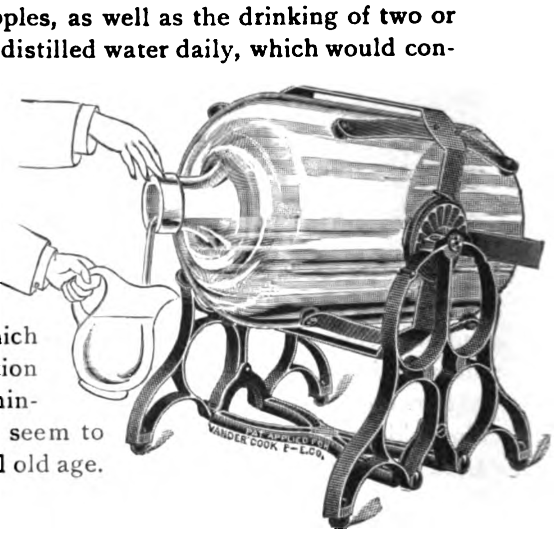
It is said the one man who is entirely indifferent whether ice comes or not is the man at Brockton, Mass., who last year set about solving "the social problem" as to himself by cutting and storing his own ice supply. He did so and after it was all in found that his ice for the summer would cost him just $7 more than he had paid his ice man for the previous summer's supply. This was before he had delivered his own ice to himself in midsummer. He has since changed his mind about the ice man's "extortion."

Pure ice can come only from pure water. Freezing does not always kill bacterial life; extreme heat does.

ICE ON THE TABLE.

Ask your ice man to leave a block of ice about fifteen pounds in weight—a cube in form, says one of those industrious and interesting newspaper writers who tell us what is good to eat, but fail somehow to say how to get it. Place the ice block, she says, in a large tin pan in a cold place, while you heat a brick red hot. Put the hot brick on top of the ice block, exactly in the center. It will quickly melt its way completely in, when it must be at once removed—the fire tongs will aid you in this. You now have a charming crystal receptacle for raw oysters, or butter, or ices, or roses. Of course you place it on a platter sufficiently large to prevent any overflow from the ice as it imperceptibly melts. Wreathe the platter thickly at the base of the ice with vines or sprays of leaves, or flowers. Another plan is to fill a round tin basin with boiling water or live coals and set it on the ice instead of using the brick. This gives a circular receptacle, a cold crystal bowl appropriate for lemonade, iced tea or coffee, or sherbets. The whole idea is very easily and quickly carried out—certainly after the first experimenting attempt; and shapes and sizes can be modified to suit various uses. A cut glass spoon or ladle is the proper adjunct. One bright young woman, with the aid of a red hot shovel and poker, created out of an ice block set upright a half-ruined tower standing on a rocky terrace. By heating her ring kettle-cleaner she gave quite a stone-like effect to the exterior, while smilax and asparagus vines ran riot through roof, window and door.

To retard physical decay, says Wm. Kinnear, in a recent article on how not to get old while growing old, a rational diet would include much fruit, especially juicy uncooked apples, as well as the drinking of two or three tumblers of distilled water daily, which would contain a few drops of phosphoric acid. This regime would tend to prevent ossification of the tissues of the body, the consolidation of which through the secretion of an excess of mineral matter would seem to be the cause of real old age.



[*Written for* ICE AND REFRIGERATION.]

ARTIFICIAL REFRIGERATION IN BREWERIES.

THE COOLING OF THE SWEET WORT—THE TEMPERATURES OF FERMENTATION—THE USE OF NATURAL ICE IN THE BREWERY AND OBJECTIONS THERETO—WHERE COLD IS REQUIRED.

By AUGUSTE J. ROSSI, B. S., C. E.

[*Continued from January issue, page 18.*]

WHEN the wort has been sufficiently boiled it is allowed to deposit, and it is then drawn off from the apparatus in which the operation has been carried. It is then cooled by proper devices, first to 60° F. or thereabout, "as rapidly as possible," and further on to about 40° F. If the hot "sweet wort" be cooled too slowly, the nitrogenous matters it contains undergo alterations through the action of the air, in consequence of which the beer becomes liable to an irregular acid fermentation, lactic acid being formed to an undue excess. The cooled wort is then transferred to the fermenting tuns, where it is caused to ferment by the addition of yeast, in order to transform into alcohol the saccharine matters it contains. It is essential that this operation should be carried on at a low temperature, 40° F. (38° to 40° F.) being considered preferable.

The saccharine matters are converted into alcohol and carbonic acid which escapes as a gas at the surface, while the nitrogenous matters of the extract are converted into yeast, part of which is expended in keeping up the fermentation, while the rest rises to the surface or settles down at the bottom (if the fermentation has been carried on slowly) and is eventually removed, to be utilized for the transformation of fresh quantities of sweet wort. Then, and before the fermentation has run its full course, the beer is transferred with proper care to the storage rooms or cellars in tanks, the rooms and tanks being kept at as low and equal a temperature as possible, 35° F., and even as low as 33° or 34° F., having been found advisable for certain beers. A slow and almost insensible process of fermentation finishes the beer, and it can then be stored in cool rooms for delivery for consumption. The rapid cooling of the hot wort and the maintenance of proper temperatures in the fermenting rooms and cellars are of the utmost consequence to the ultimate qualities of the product. It is in the realization of the best conditions of temperatures during the different stages of the manufacture that the artificial means of producing a cold controllable to any degree required has met with the most incontestable success by insuring the greatest degree of economy.

Not only the temperature at which the fermentation is carried on has a decided influence upon the quality of the beer, but it has one also on its power of keeping without souring when once prepared. When the fermentation temperature reaches at least 65° F., as is the case with many beers made in England, France, Belgium and western parts of Germany, the beer has been observed to become sour by contact with the air, the alcohol being slowly transformed into acetic acid by a process of gradual oxidation. Bavarian beers fermented at temperatures not above 45° F. (40° to 45° F.) are not subject to such alterations. We will not enter here into the details of the scientific explanations which have been given by Liebig of this influence of the temperature. They amount in brief to the following: The higher the temperature at which the fermentation is carried on and necessarily the more tumultuous it is, the bubbles of carbonic acid gas are more abundant and large and keep the liquid in a state of constant agitation, carrying up to the surface in their ascensional motion through the liquid the greater part of the yeast, and the fermentation proceeds, so to speak, from the top. In rooms artificially cooled, on the contrary, and maintained at a uniform low temperature, the fermenting tuns, the air and liquids are practically at the same even low temperature; the fermentation in these conditions proceeds slowly; the bubbles of carbonic acid gas escape regularly, in a gradual manner, are small, and, instead of raising to the surface the yeast in which they might have remained imprisoned otherwise and even keeping it in the mass at the risk of its being carried off with the beer when it is drawn off, they allow it to settle to the bottom of the tank.

The famous "March Beer" of certain northern countries in Europe owed its antique reputation (before cold in some form had been applied to breweries) principally to the fact that it was prepared in conditions of low temperatures, its manufacture being carried on in such seasons of the year and in those countries where these favorable circumstances obtained. Beer is preeminently a fermented liquid, and it must be so prepared that when it is consumed it still has "life" in it, stale beer being both insipid and unwholesome. This "life" is due to the escaping of small bubbles of carbonic acid gas, the result of the last stages of an almost insensible process of fermentation going on still in the cask, owing to the presence in the liquid of small quantities of ferment—just enough and no more. Hence the necessity for the intelligent brewer, in order to insure

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to his product its best characteristics, to maintain the liquids under treatment, at every stage of the process, under such conditions as to be able to control the fermentation and the kind of fermentation within absolute limits. Cold is the agent *par excellence* to check the manifestations of organic life.

The wort, as we have seen, is a mucilaginous and saccharine liquid, containing an important amount of nitrogenous substances. These substances are liable, under certain influences of temperature, to develop, beside the ordinary and looked-for alcoholic fermentation, acid, lactic, viscous and even putrid fermentations. These influences confront the brewer at every step, but he has at his disposal the remedy, if he knows how to avail himself of it and apply it judiciously. It is a known fact that alcoholic fermentation sets in at a lower temperature than the other kinds of fermentation alluded to. Not only must the brewer make use of cold, but he must be able to control it at will: he must be able at a given moment to lower the temperature below a certain degree in order to correct an undue and detrimental fermentation.

These conditions have led the brewer for years past to the use of natural ice whenever it has been possible for him to procure it, notwithstanding its cost sometimes or the difficulties to obtain it in certain localities. But in countries where ice is a rare article, or where nature denies it completely, the brewer has had only the resource of natural well or spring waters, more or less cool, in most cases insufficient on this score, and the cause of many disappointments; or his industry has been limited to special privileged countries or to certain seasons of the year.

In order to utilize natural ice several methods have been resorted to. One of the most serious objections to its use is its solid state, which does not allow of its being handled economically. To have it at his disposal and in abundance when required, the brewer has been obliged to store it at such seasons when it could be harvested, or to store the product transported from colder climates, in huge and cumbrous ice houses, costly, to say the least, both as to construction and on the score of their occupying a place in the brewery which could otherwise have been made available with advantage for useful purposes. It might be said that the brewer could have avoided this storing up and buy from day to day the ice he required in the summer months. Without mentioning the extra expense incurred by such practice, it leaves him at the mercy of the ice dealers in seasons when the natural crop has been deficient, and the price he has to pay for it in such circumstances becomes an important factor affecting materially his legitimate profit. In this respect the use of artificial means to produce ice only when wanted and in such quantities as may be required, independently from any conditions of climate or market, relieving the brewer from the obligation of constructing large storage houses, proved an immense improvement until better and more efficacious means of utilization of the artificial cold were introduced.

The mode of utilizing ice has been most generally by preparing with it cold water, which could be circulated through proper devices wherever a low temperature was required, and to pack large chunks of ice in the rooms to be cooled in order to lower the temperature of the air and the contents. Apparently simple as this method may appear, it is easy to see that in many cases it must have proved insufficient. With cold water the temperature reached by the liquid intended to be used for purposes of refrigeration cannot be below 30° F., the melting point of ice, a figure never reached unless quantities of ice inadmissible on account of cost be used, at any rate never below. The liquid or substances to be cooled, necessarily for a good transfer of cold, must be at a few degrees above, and it is difficult by such means to obtain a minimum temperature of 35° F. or 38° F. even, and especially to maintain it. With certain beers containing smaller quantities of alcohol, in which the injurious fermentations we have previously alluded to are liable to develop, if the temperature of the liquid reaches above what may be called the critical point, such temperatures are not sufficiently low, or, more precisely, they cannot be depended upon to remain at that figure; in which case the brewer has no means to control and check an irregular fermentation when once it sets in.

The cold, in the process of brewing, is required, as we have seen, more especially at three stages of the manufacture :

1. To cool rapidly the "sweet wort" as it comes from the mashing and boiling vats to 60° F. first and then to 40° F.

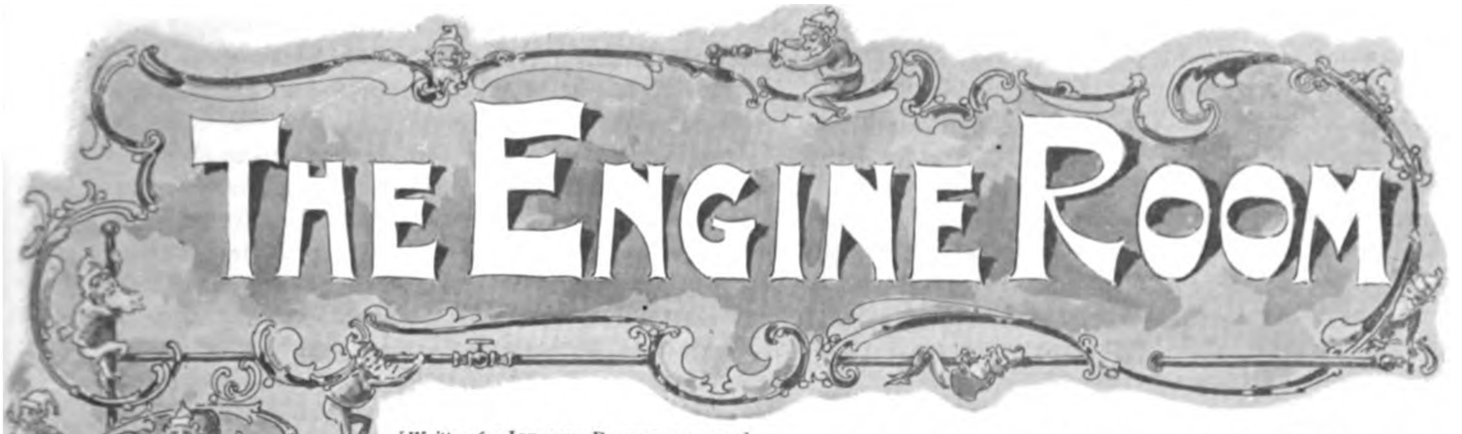
2. To cool to a temperature of 38° to 40° F. the rooms and the fermenting tuns in which the wort has been drawn off and in which tuns the wort is in process of fermentation.

3. To maintain the liquid now fermented, but not quite completely, in storage rooms or cellars at a temperature of 33° to 35° F., in which rooms the fermentation continues very slowly and at a low temperature—an important factor at this step; and, lastly, to maintain in the racking room from which the casks are loaded to the delivery wagons a temperature of 35° to 40° F. in order to preserve in the beer some traces of the ferments in a state of latent inaction, which will ultimately, when it is consumed, give to it those sparkling qualities which characterize a good product. The manner in which the last operation is conducted with natural ice is to pack chunks of ice around the casks, a practice which obviously involves a great loss of ice, the resulting cold water being wasted most generally, and becomes the cause of dampness and rotting everywhere, without mentioning the labor it necessitates.

[TO BE CONTINUED.]

THE quantity of game handled yearly in Minnesota by cold storage companies has of late become very large—at least 4,000 carcasses of venison for the past year, and for the same period 280,000 birds. From Lake Pepin alone there have been shipped this year over 500 tons of coarse fish, such as sturgeon, cat fish, red horse, etc. More than 6,000 tons of fish are annually handled in the cities of St. Paul and Minneapolis and Duluth.

THE city of Frankfort, Ind., was to have an artificial ice plant, but the projectors have weakened, the committee which visited Anderson, Peru, Connersville, etc., having made an unfavorable report. It is said the committee found but one plant that claimed to be making money. They must have gotten into a "queer" neighborhood.



[*Written for* ICE AND REFRIGERATION.]

THE PIPING IN COOLING ROOMS.

THE EFFECT OF THE INSULATION OF THE WALLS—AMOUNT OF PIPING FOR BRINE CIRCULATION AND FOR DIRECT EXPANSION—THE RULE IN BREWERY PRACTICE.

BY OTTO LUHR.

TO correctly proportion the piping in the different rooms about a refrigerating plant is a most difficult task, as it is beset with so many uncertainties. If we knew exactly the insulating properties of the walls and roof, and the amount of heat that it would be necessary to extract from the contents of the room, the required amount of piping could be easily calculated on the same principles by which the radiating surface for heating purposes is found for the different systems of steam and hot water heating. In the heating of buildings the important factor is the number of cubic feet of air to be heated to a given temperature, together with a supply sufficient to balance that portion which is transmitted through the walls and windows of the room. Even when all of the points mentioned have been considered, other unforeseen conditions will modify to a certain extent the amount of radiating surface necessary; for the exposure of the sides of the room and the prevailing direction of winds have an influence, and the radiating surface must be provided accordingly.

In refrigerating and cold storage plants, the first point to be considered is the insulation of the walls. This of itself is fast reaching the exactness of a science, so that in time designers will be able to calculate exactly the amount of heat to be absorbed from this cause, which will, of course, depend on the difference of temperature inside and outside the room, which is a continually varying amount. So also is the heat contained in the matter with which the rooms are to be filled. These varying amounts make it impossible to proportion exactly the amount of piping required for the varying conditions.

It is for these reasons that the pipe surface is seldom made just what is required, unless a sufficient quantity is put in at the start to meet all the requirements afterward. The best result yet obtained in this line is where the piping has been put in slightly in excess of the calculated requirements and provision made for cutting out one or more lines of pipe as may be found necessary; and as such requirements occur whenever the temperature of the atmosphere falls a few degrees, any one can understand that it is better to have a sufficient amount of cooling pipes to answer the greatest demands of the plant and yet provide for economy by cutting out a portion of the cooling surface whenever it is thought advisable. Such changes can easily be made on brine systems, where the piping is usually arranged parallel, the same as the radiators are connected to the mains in steam heating by the two-pipe system, where one or more radiators may be shut off without interfering with the operation of the others. If direct expansion is used, the pipes should be connected in the same manner, so as to permit of being handled to suit the requirements, as I think that better results would be obtained by so doing than by changing the pressures.

In the plant that I have charge of, Wacker & Birk's brewery, Chicago, I believe that I have succeeded in securing greater economy in the working of the plant by adding more cooling surface in many of the rooms; in fact, in some places the cooling surface, as installed, was not sufficient to do the work as desired when operated under the usual conditions. We use direct expansion to a limited extent, and brine circulation in the most of the rooms. Neither of these systems applies exactly, according to the common rules used for steam heating, regarding the number of heat units supplied; for in one case the heat units are being supplied by the steam, and in the other case by the substances to be cooled. In one case the difference in temperatures amounts to comparatively few degrees, consequently the cooling surface must be greater in proportion to the amount of heat to be taken away than in cases where greater difference of temperature is employed and the heat is to be imparted to the surroundings.

The insulation of the walls has not proved equally good in the different rooms, and I find that the loss varies from 3 to 10 per cent; but as this part cannot be changed, good results are obtained by varying the amount of cooling surface in use, as I have already explained. As there is considerable difference between the specific heat of ammonia and that of steam, this fact must be taken into consideration when calculating the amount of cooling surface for new rooms; and if it is known just how much heat must be removed from the room within a given time, a fairly good approximation can be made by calculation, and with the figures I employ I get enough cooling surface to do the work rapidly as is required. After the surplus heat is removed the only duty required from the pipes is to absorb the

heat which passes through the walls and that developed by the workman in the rooms.

The method generally followed for cooling rooms, properly insulated, is to allow about one to thirty; that is, for every thirty cubic feet of space one square foot of cooling surface is given; but in general practice this is not enough when economy of fuel is considered, because there are many things which have to be taken into consideration that do not seem to have been provided for by such estimates. The shape of a room, whether square or rectangular, I find, has some effect on the results obtained, and there are other little items in each individual plant which have to be dealt with. If we consider the necessities of refrigeration in a brewery, for instance, we must have different temperatures in different rooms, and this will apply also to most other refrigerating plants, but in different degrees. In a brewery the fermenting room is the one requiring the most particular temperature, usually about 3° above 0° F. There I use brine circulation with about one to three; that is, one square foot of pipe surface to three cubic feet of space in the room. If, then, we use 1-inch pipe, we say: one running foot of pipe to eight cubic feet of space. I don't like to use such small pipe, especially in long lengths, for I think that better results are secured with a size larger, or 1¼-inch pipe; for with 1-inch pipe the brine becomes too warm if it traverses a distance of more than 400 feet, but with 1¼-inch pipe the length can be 600 feet before the brine will absorb enough heat to reduce the effect very much. One great object in using plenty of pipe is to enable us to keep the temperature of the fluid high, more nearly the temperature of the room, which means economy in operation.

The above considerations apply equally well to other rooms, but a different proportioning of pipe surface is found necessary, and in the lower cooling rooms one running foot of 1-inch pipe to fifteen cubic feet of space, one to twenty, one to twenty-five, and so on, depending on circumstances, can be used and good results obtained; but on an average, before knowing just how the room is to be filled, I would use one running foot of 1-inch pipe to fifteen cubic feet of space, or one square foot to four cubic feet of space, if other sizes of pipe were used; and would consider that I had sufficient cooling surface to meet any ordinary requirement. I should connect the pipe in different lines so that one or more lengths could be cut off, as might be found necessary. This is the proper arrangement in all cases where brine circulation is used.

Where direct expansion is employed, the proportionate amount of piping will be different, for the temperatures are more widely separated, but not nearly so much as in steam heating, and, consequently, less pipe surface is required; but as the pipes must be of sufficient size to carry the necessary amount of ammonia to produce the refrigeration required in that portion of the plant, they will usually be found large enough for the purpose if radiating disks are employed. I think these little devices are most useful for the purpose, because as many or as few as may be needed can be employed. These disks, or flanges, are flat castings that can be attached to the pipes at any place required, and are fastened in position by small bolts. These disks, owing to the low temperature of the pipes, present effective cooling surface, as is shown by the thickness of frost being the same over their entire surface; but the same device does not work equally well on brine circulation because the temperature of the brine and that of the rooms is more nearly equal.

In selecting the size of pipe it is not well to take the smallest, even if it does give the greatest amount of surface for the weight of brine it will contain, because in small pipes the friction presents a resistance to the flow which develops a certain amount of heat that must be absorbed, and to no good purpose. It is much better, in my opinion, to have the pipe somewhat larger, for then greater lengths can be run before the brine becomes heated sufficiently to lose its efficiency, and the flow through the pipes is also slower, which means less waste from friction. This is an important point where the brine tank is not set very high above the cellars or the pump, for I do not think it advisable to increase the velocity of brine in the pipes by the use of the pump.

[*Written for* ICE AND REFRIGERATION.]

LEAKAGE OF COILS IN BRINE TANKS.

ACTION OF AMMONIA-CHARGED BRINE ON THE PIPES AND FITTINGS —INDICATIONS OF GAS—TESTS FOR AMMONIA IN SOLUTION —LOCATING THE LEAK—MAKING REPAIRS.

BY CHARLES DESMOND.

A LEAK from the ammonia coils into the brine tank is not so difficult a thing to detect and locate as might at first be supposed, if we go at it in a practical way and make use of the knowledge which the science of chemistry has supplied us. Then by using our ordinary knowledge of engineering the location of the trouble can be found and the proper remedy applied.

The affinity between the water of the brine and the ammonia is so great that the ammonia is absorbed with great rapidity, and the compound has no appreciable odor until saturation has proceeded so far that a considerable weight of ammonia has been added to the brine. When this condition has been reached, the contents of the brine tank represent an outlay of considerable money, even though the amount of ammonia thus wasted is not sufficient to saturate the brine so that the existence of a leak can be known from the odor in the room. Before such a degree of saturation is reached the brine will be charged to such an extent that the action of the ammonia on the copper in the brass fixtures will have proceeded so far that they will have become greatly impaired and in some cases rendered useless.

Our *data* on the saturation of ammonia to the extent that its presence can be detected by the odor are limited, and do not give sufficient information to enable us to venture a suggestion even; but we can assume that the average pressure, due to the weight of brine in the tank, will be about two and one-half pounds. Then, considering that the water will absorb about 750 times its volume of ammonia, we find that there would be something more than five pounds of ammonia to each cubic foot of brine. When this and the number of cubic feet of brine in the tank are considered, the loss from the ammonia wasted will be found to amount to considerable; and it is, therefore, just as important to prevent leaks of ammonia, although they may be in a locality where the odor may not be perceived, as it is to prevent all, even the slightest, leaks about a steam engine.

The value of the ammonia wasted is not the only thing of importance; for its action on the valves and

such brass fittings as the brine system may contain will soon cause so much corrosion that these will have to be renewed or repaired to make them reliable. This corrosive action will take place to an injurious extent long before the brine is so saturated with ammonia that the odor will attract attention, as has been shown by the wearing away and pitting of the brass piston rod in the brine pump, and the difficulty of keeping the stuffing box from leaking. With such action on these parts, the extent of the corrosion on the valves in the branch pipes may be guessed at. When the stuffing box of the pump persistently leaks and nothing is found wrong with the packing, it may be taken as an indication that the brine contains ammonia; and if pitting, or small pin holes, show in the rod, it may be taken as positive indication of the presence of ammonia.

The above-mentioned troubles with the rod may be taken as sure indications of a leak in the brine tank; but the leakage should never be permitted to go so far; for a simple test of the brine with reddened litmus paper will show the presence of ammonia in the smallest proportion. Litmus paper is made from the fiber of a plant treated chemically, and is of a grayish-blue color. It can be purchased in any drug store. It makes a very simple and sensitive material for making tests for any acid or alkali. As ammonia is an alkali, the paper is already adapted for making frequent tests of the brine, so that a leak may be detected before the loss of ammonia has amounted to much or become sufficient to do any damage to the fittings. The litmus must be prepared for the ammonia test by coloring it red, which can be done by dipping it into a small quantity of vinegar diluted with an equal quantity of water. This immediately gives it a red color, proportionate in depth to the strength or acidity of the vinegar. Any acid will produce the red color if applied in a similar manner. The paper should be reddened and kept ready for use, and the test made frequently by wetting the paper in a small quantity of brine taken from the tank. The presence of ammonia will be shown by the paper's turning blue, and the intensity and rapidity of the change of color will be an indication of the amount of ammonia in the brine, whether it be much or little; for with only a small proportion of the alkali in the brine the color will change but little, and not very rapidly, as there may not be enough alkali present to neutralize the acid with which the paper was colored. For the foregoing reason, it is best, when coloring the paper, to use a weak acid and not make the coloring too strong, for then the paper will be a most sensitive test. Acid will neutralize the alkali and change the color of the paper from blue to red; so that is about the best test known for both acids or alkalies.

Locating a leak in the brine tank, when it is known to exist, is easily accomplished by pumping all the ammonia possible from the pipes and storing it in the condenser and liquid receiver. After having closed the expansion valve, then close the stop valve and open the cross-connection so that the pipes can be filled with air. All ammonia compression systems have these cross-connections (if not, they should have), and the air pressure can be easily applied. Pump air into the pipes until bubbles rise through the brine. These will show in what part of the tank the leak is located; and then by keeping a pressure of air in the pipes while running off the brine the leak can be found as the pipe is uncovered. When running off the brine it is not necessary to try to save it, as new brine will give equally as good results and perhaps better, while the cost of the new brine will not amount to as much as will the cost of some means for saving the old. The amount of ammonia contained in the old brine would be of value if it could be extracted and utilized, but to do this would cost more than the value of the whole.

The best method of repairing the defect after it has been located and its nature discovered, will depend altogether on the conditions. If the leak proves to have been caused by a split in the pipe, a pin hole, or something of that kind, and it is not very extensive, it might be that soldering the pipe would answer the purpose. A soldered joint is not to be recommended for such work, as new coils only are the proper means of repairing such a defect; but at many times the conditions may be such that the time cannot be taken for putting in a coil, and making a weld might also require that the plant should stand longer than the nature of the refrigeration to be produced would permit, and something will have to be done very quickly. When such are the requirements, then it would be advisable to make a soldered joint, which can be done in a very few minutes if the proper tools are at hand. To make solder stick to iron, it is necessary that the iron surface should be quite clean at all points where it is intended that the solder shall take hold. The iron should be filed or scraped bright; the soldering fluid should contain a small portion of salammoniac, and the soldering tool should be as hot as it can be made without "burning." Without the salammoniac in the soldering fluid, the solder can only be made to stick to the iron, not forming a true soldered joint. Soldering fluid is made by dissolving to saturation in water the salt chloride of zinc, or it may be made by dissolving in muriatic acid as much zinc as it will cut, but a surplus of zinc will do no harm.

THE daily papers of some of our cities place their readers under obligations by reporting from day to day the state of the weather in Paris, it is supposed in order to supply data to those "good Americans" who expect to die and go there soon. Those choice spirits who expect their reward in the near future, but who have not kept entirely "posted," will be glad to know that though no winter had put in an appearance until after the holiday season was over, nevertheless, another (the second) artificial ice skating possibility was opened about January 1. "Prince de Sagan went, with his eyeglass and its broad ribbon, to inspect the Palais de Glace," we are told. "His highness and its fashionable authority pronounced its aristocratic fate, and the thing was made a huge success. Everybody went to the opening, and everybody had a jolly time. The Champs Elysees now enjoy the sporting monopoly. The petit cycle rink and the ice palace can put in a day very comfortably, with advantage to health and to social rank. In solitary companionship the tax is a small one, but as you usually go in a crowd, with lunch, tea or supper thrown in, the luxury is sufficiently extravagant to remain exclusive."

THE dealers of Boston claim that since January 1 cold storage eggs are selling for less than it cost to put them in. And the rest of the world say, "Here, too."

[*Written for* ICE AND REFRIGERATION.]

ABSOLUTE ZERO.

IS THE TERM A MISNOMER AS COMMONLY USED—MEANING OF THE EXPRESSION AND ITS SCIENTIFIC IMPORT—RECENT EFFORTS TO REACH ABSOLUTE ZERO.

BY J. E. SIEBEL.
Director of the Zymotechnic Institute, Chicago.

THE scientific import and significance of the conception of an "absolute zero of temperature" is a subject which is still imperfectly understood. The term in question is still looked upon by many as a hollow scientific abstraction, or a hypothetical fiction of misleading latitude. This is evidently the view taken on this subject by Dr. Henry Wurtz, who, in an article published in No. 941 of the *Scientific American Supplement*, and headed "The Absolute Temperature, So-called," makes (what at first sight might appear) a strong argument against the use of this term, which he calls a misnomer if used in the sense of "absolute zero of heat," and urges that the same be used only in the sense of "absolute zero of gaseous elasticity." Says Dr. Wurtz:

> The term may have been introduced by Clausius or Rankine, and it may be that the original meaning was only to indicate the point of temperature at which all gaseous expansion disappears, according to the Boyle-Mariotte law, and not to signify a temperature at which all matter becomes destitute of the power to impart heat energy altogether; or in other words, a point at which matter is so cold that it cannot get any colder. Yet this latter is the sense in which the term is often applied in scientific writings.

To this application Mr. Wurtz objects, and to sustain his objection he quotes from Watts' "Dictionary of Chemistry" (edition of 1865) that portion which shows how the conception of absolute temperature may be derived from Boyle's law on the expansion of gases, as though this was the only or principal support for the introduction of the term "absolute temperature" into scientific deliberations. This, however, is not the case; another more indirect but alike acceptable foundation for the conception of absolute temperature is based on the fundamental principles of the indestructibility and convertibility of energy and the equivalence of heat and work in particular. The development of the conception of absolute temperature gained thereby dates back to Carnot, and it has been fully matured by Clausius, Rankine, Thomson and others. The drift of the discussions of these gentlemen, however, does not only "concern the steam engine" or engines propelled by other gaseous matter, but in its consequential bearing covers every mode of conversion of heat into work, no matter in what manner this may be effected.

As early as 1824 it was irrefutably shown by Sadi Carnot that the maximum amount of work which could be done by an ideal reversible engine (the most perfect machine for such purposes imaginable) by transferring heat from a warm to a colder body depends solely on the temperature of the hot and cold body and is independent of the working substance which accomplishes the transfer. It is evident that the amount of work which can be obtained from a certain amount of heat in the above named way (leaving out friction and other losses which are not considered in an ideal process) can never exceed the mechanical equivalent of that amount of heat. In fact the theoretical maximum yield or effect of such a perfect engine under possible working conditions is always considerably less than the mechanical equivalent of the heat employed; it is only a certain and definite portion of the latter. This portion can be readily ascertained by examining after the ingenious method devised by Carnot, the changes of the working substances by means of a diagram in which the abcissæ and ordinates denote the change in volume and pressure of the working substance in going through the cycle of operations indicated. The amount of available and diffused energy can then be calculated from the areas limited by the co-ordinates, etc., in a form properly adapted for comparison. In doing so it was found that the relation between the work W that may be obtained from an equivalent amount of heat H both expressed in mechanical units, may be expressed by the formula:

$$W = \frac{H\,a\,(t_1 - t_0)}{1 + a\,t_1}$$

In this formula t_1 represents the temperature of the warm body, t_0 the temperature of the cold body, and a the coefficient of expansion of an ideal or perfect gaseous body. This formula may also be written:

$$W = \frac{H\,(t_1 - t_0)}{\frac{1}{a} + t_1} = \frac{H\,(t_1 - t_0)}{273 + t_1}$$

And from the latter formula it follows that the maximum effect that can be expected from any system will be gained when—

$$= t_1 - t_0 = 273 + t_1$$

which happens when t_0 is equal — 273, or in other words, if the temperature of the colder body is 273° Celsius below the ordinary zero or freezing point. In this case W is equal H, and the actual work is equal to the mechanical equivalent of the heat employed. If a colder temperature than — 273° were granted to be possible in the colder body, it would be like saying that under such circumstances a greater amount of work could be obtained from a certain amount of heat than would correspond to its mechanical equivalent. The possibility of a *perpetuum mobile* of the first order, and other inconsistencies, would follow as a matter of course. And if it were only to avoid these incongruities, the conception of an "absolute zero of temperature," somewhere in the neighborhood of — 273° Celsius is not only desirable but a scientific necessity, and its real existence is established with a logic equally unassailable in this case as in the case of most other conceptions in natural philosophy.

It is readily understood why the point of absolute zero reached by the above process of reasoning is quite identical with the point found by simply elaborating the formula expressing the Boyle-Mariotte law. In both cases the coefficient of gaseous expansion enters as the numerical factor in the same capacity, algebraically speaking. But it must not be assumed for this reason that both processes of reasoning are really identical, and that the former thermodynamical process of reasoning is merely a laborious circumscription of the latter.

Indeed, it is not, for when the elaboration of Boyle's law yields the temperature at which gaseous expansion or pressure (that is, of an ideal perfect gas) becomes zero, then the above thermodynamical process of reasoning shows in addition that this temperature is also the lowest temperature compatible with the existence of the

fundamental laws contemplating the indestructibility of energy and the equivalence of different forms of energy among each other. In other words, that temperature represents the absolute zero of heat, that point at which, speaking in the language of the molecular theory, all molecular motion demonstrating itself as heat must cease.

Although the point of absolute zero has not yet been reached by actual refrigeration, yet we have come considerably nearer to it since the dictionary quoted by Dr. Wurtz was written. Most astonishing progress has been made recently in this direction by Pictet, Dewar and others, and the results obtained by them will by themselves overthrow Mr. Wurtz's objections if they are not fully disposed of by the thermodynamical reasoning as given above.

As regards the significance of Boyle's law in this connection, a strict distinction must be made between the ideal and perfect gas to which this law applies and the gaseous bodies, broadly speaking. The gaseous conditions, and especially the one represented by Boyle's law, is used preferably in thermodynamic discussions. By it the phenomena of heat, pressure, etc., are represented in their greatest purity not marred by cohesion and other properties of matter; and while such an ideal gas may be a total fiction or abstraction, the reasoning based on such abstraction gives the nearest approximation to truth attainable at present. None of the gaseous bodies in nature obey the laws of Boyle and Mariotte, and it would be equally absurd, or at least equally useless and idle, to speak of an absolute zero of elasticity of hydrogen, as of the "absolute zero of elasticity of the vapor of paraffine wax." The one, like the other, liquefies before the absolute zero of temperature is reached. The possibility that a "body colder than liquid hydrogen might be dipped in the latter and chill it into a solid form," is in no way inconsistent with the existence of an absolute zero of temperature, as apparently supposed.

In accordance with recent experiments made by Dewar it appears that hydrogen will turn into a liquid at about 240° below zero, and from this we may infer that it will become also a solid before the temperature of —273° Celsius is reached. In the case of oxygen the difference between the boiling and freezing points appears to be about 25° Celsius and by analogy between this and other gases we may assume that the difference in the case of hydrogen is even less, and that accordingly it is likely to solidify below —265° Celsius.

The above fact disposes of the argument as to the heat of liquefaction that would be contained in liquid hydrogen after the same had become a liquid at or near —270° or —273°, since this liquefaction takes place much above this temperature.

The argument that even the frozen hydrogen would still possess "all the potential energy that it evolves when it burns after having received back again in addition its latent heat of fusion and its gaseous elasticity," also involves an assumption which is altogether at variance with the theoretical views touching the subject of molecular physics and chemical affinity.

In accordance with these views the "potential energy" representing in a measure the chemical affinity is not an independent quality and quantity, but simply a partial demonstration of the energy stored up in the body as heat of liquefaction, volatilization and as sensible heat. This view is not only in accordance with the teachings of thermo-chemistry, but is also confirmed by Prof. Dewar's experiments in accordance with which chemical affinity ceases to act at low temperatures, liquid oxygen being unable to support the further combustion of a glowing stick of wood immersed therein, etc.

Much more may be said on this subject, but the above, I trust, will suffice to show that the terms "absolute zero of gaseous elasticity" and "absolute zero of temperature" are coexistent and inseparable, if indeed, not synonymous. Future experience may and doubtless will change our views on many subjects, but at present the term "absolute zero of temperature" is so much in accordance with the facts that its absence in scientific parlance would be seriously felt by teacher as well as student, and as to its having "been a factor in shaping investigation and in guiding scientific thought" may it continue to do so in an equally fruitful manner in the future as it has done in the past.

COMBUSTIBLE GASES.

THE following matter, for which the editor of ICE AND REFRIGERATION is indebted to Mr. Geo. Richmond, M. E., of New York city, will no doubt be of interest in connection with recent articles in this journal on combustible gases in ice machines:

COMBUSTIBLE GAS FROM A HOT WATER HEATER.

H. H. HILL, Brandon, Vt., writes:

"I have a hot water apparatus in my house. I was told to open the air cocks and let the air out. I did so as often as two or three times a week, and one evening, with a lighted lamp in my hand, I opened one, and it took fire, burst the chimney, and came very near setting the house on fire. After two days any of them will burn like a gas jet for about one-fourth to one-half a minute. This appears to be a little dangerous. What is the matter? It did it all last winter, and I thought it would get over it this summer, but it hasn't. What is to be done? Has my steam fitter made a mistake and sent me a gas generator instead of a hot water apparatus?"

[The *Engineering Record* has frequently noted this occurrence. There is nothing whatever dangerous about it, as it is presumably only a hydro-carbon gas. Whether it is formed by the decomposition of the water direct, or by some impurity in the water, we do not know. It is well known, however, that particles, such as oil, etc., will decompose on the inside of a hot surface, and that the gas thus formed is insoluble and will separate from the water. There is no danger from it, however, as it cannot ignite until mixed with air, and the quantity is inconsiderable.]

THE last specimen of "earth's benefactors" is the Kansas City genius, W. B. Dickson by name, and typewriter manipulator and inventor by nature, who was recently granted a patent for an ice meter, to be attached to refrigerators. It is said that by its use the ice consumer will be no longer at the mercy of the ice man and the ice man will no longer be compelled to listen to the complaints of his customers. The device weighs the ice as it is day by day put into the ice box, and registers the weight of each day's purchase on a monthly register, so that at the end of the month a look at the register will show the exact number of pounds used during that period. It indicates the exact number of pounds of ice remaining in the refrigerator at any time of the day, thus enabling the owner to know whether or not it is necessary to order ice. There are also other advantages attached to the use of the meter, chief of which, it is hoped, will be its facility for walking out to the wagon and "toting" the ice back to the box, as well as collecting overdue bills.

[*Abstracted for* ICE AND REFRIGERATION.]

LEGAL MATTERS.

RIGHTS IN ILLINOIS OF BUILDERS OF REFRIGERATING MACHINES WHICH PASS WITH PLANTS INTO RECEIVER'S HANDS BEFORE BEING PAID FOR—MINOR LEGAL NOTES.

IN 1892 (January 12), the La Salle Brewing Co., La Salle, Ill., made a contract with the Hercules Iron Works for the erection complete of a 25-ton refrigerating plant. The agreed price was $10,500, to be paid for as follows: $2,625 in cash on delivery of the machinery; $2,625 in cash on the complete erection of all machinery as specified; $2,750 by notes dated April 1, 1892, payable four months from date, with 6 per cent interest; $2,500 in first mortgage bonds bearing 6 per cent interest, due in ten years, to be delivered at the time of the second payment.

The plant was put in and first payment made as agreed. The second payment was paid, not in cash, but by 90-days note duly executed and delivered. On April 19, 1892, note for third payment was given, and late in June the $2,500 of 6 per cent ten-year mortage bonds were delivered. None of the notes were paid.

On November 9, 1892, the brewing company made an assignment, and the assignee applied to the County court for leave to sell the property. In January, 1893, the Hercules Iron Works filed its petition with the court, setting up the history of its case, and claiming under its contract the right to remove the refrigerating plant, it not having been paid for. The court, however, ordered the Hercules petition dismissed and the property sold, which sale took place February 23, 1893, for $42,000, subject to taxes and two mechanics' liens, which sale was approved and assignee ordered to execute deed of purchase.

The case was then taken to the Appellate court of Illinois by the Hercules Iron Works, which court rendered decision in their favor. After reciting the facts above this court say:

Appellant contends that the La Salle Brewing Co., having made default in the payments, appellant (Hercules Iron Works) had the right to remove the refrigerating plant as against the brewing company, and that such right exists as against the assigned and other defendants to the petition. Not only was the default made in the second and third payments, according to the terms of the contract, but those payments have never been made. The second payment was not made in cash, but a note, which has never been paid, was given instead.

Although it has been held in several of the states that the giving of a negotiable note in consideration of a simple contract debt discharges the contract on which the debt was founded, the decided weight of authority in this country and England is to the contrary. To have that effect it must appear that it was agreed that the note should be taken in absolute payment, or that the creditor has so parted with the note as to subject the debtor to double payment. Except in a case where the evidence raises a positive inference of discharge, the burden of proof is in the debtor to show that the note was both given and received as an absolute payment. We think a court should with great caution reach the conclusion that the evidence raises an inference of discharge in a case where the creditor would thereby lose some security which he held before taking the note. In this case, appellant reserved by its contract title to the property with the right to take possession and remove the same unless all payments were fully made. It can hardly be presumed that appellant, when it took the ninety-day note, at a time when the brewing company was hard pressed for money, intended to release the security provided for by the contract.

As between the parties, the contract was legal and valid. Had no assignment been made, and had the brewing company remained in possession of the property, there could be no question of the right of appellant, at the date of filing its petition, to enter and retake the property. The assignee, in relation to the rights of appellant, occupies no different position from the brewing company. Under a general assignment, the assignee takes as a mere volunteer, and the property assigned is subject to the same defects of title, equity and liens as when in the hands of the assignor. Of course, when such a contract is made, it is with the risk on the part of the vendor of losing his right to take the property by its being levied upon by creditors of the purchaser while in his possession, or by its being sold to a purchaser without notice. In this case, however, at the time of filing the petition, there were no judgment or attaching creditors of the refrigerating plant, or the premises on which it was situated had not been levied upon, and there was no *bona fide* purchaser without notice. There was no evidence of any creditor having a lien against whom the contract would not be valid. The premises were bonded before the refrigerating plant was put in or the contract made. At the time the bonds were issued, the plant was no part of the security taken. The fact that it was to become a part of the realty when permanently affixed to it, is subordinate to the intention expressed by the contract. There was no proof that any of the bonds went out of the hands of the company or the trustee after the plant was put in, excepting such as were received by appellant under the contract.

We are of the opinion that the order of the county court dismissing appellant's petition should be reversed, and the cause remanded with directions to take further evidence, and render an order which will fully protect appellant in its rights under the contract as viewed in this opinion. R. and R.

IN THE matter of injuries to an employe resulting from the negligence of a superintendent, the Supreme court of errors of Connecticut has decided (*Gerrish* v. *New Haven Ice Co.*), that where an employe of a corporation is injured by reason of the starting of machinery by the absence of the superintendent and manager from the place where the rules of the company which were known to the employes, required him to be, and because he failed to notify the engineer, as it was his duty to do, of the dangerous position of the injured employe, which was known to him, the company is liable for such injuries.

MINOR LEGAL NOTES.

——The Michigan statutes make it a misdemeanor punishable by a fine of not more than $100, or imprisonment in the county jail for not more than three months or both, at the discretion of the court, for any person engaged in procuring ice from any streams or lakes in this state to fail to erect or place suitable danger signals at or near the places where they shall be cutting ice.

——Anton Thissen has commenced action against Chas. D. Swanson, for alleged breach of contract. They were in the ice business at Mankato, Minn., last year, but dissolved partnership last fall, Mr. Thissen succeeding to the business. In the agreement, Mr. Thissen alleges that Mr. Swanson bound himself not to engage in the ice business this year, but claims that he has violated the agreement and is in the ice business under the firm name of F. B. Swanson & Co.

——In 1890 F. A. Platt & Co., of Flint, Mich., sold a large ice house with ice to Frederick Jager, of Columbus, Ohio, receiving $100 down and Jager's note for the balance, payable in ten days. Before the expiration of that time the ice house burned and the ice melted, and Jager failed to pay his note when due. Suit was commenced in Columbus to recover, and December 27 judgment was rendered, giving Platt & Co. a judgment for the full amount of the note, deducting the amount paid.

——The Oak Grove Farm Co., Boston, with a farm at Millis, several restaurants in Boston, and a milk route, has assigned for the benefit of its creditors to three trustees, F. H. Williams, S. B. Hibbard and F. C. Dow. The liabilities are about $100,000, and the opinion seems to be that the assets will be sufficient to pay a large dividend. The trustees will conduct the business for the present. The president of the company was Henry L. Millis, who was also president of the Oak Grove Farm Artificial Ice Co., the Millis Co., and the Steel Edge Stamping and Retinning Co., and was also treasurer of the Chicago, New York & Boston Refrigerator line, the Live Stock line, the Milwaukee Manufacturing Co., the Pacific Transportation Co. and the Chicago Furniture Co. He has resigned from all. S. B. Hibbard has been elected treasurer of the refrigerator line, and F. H. Curtis, assistant cashier of the Broadway National Bank, treasurer of the other companies.

ICE AND REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION, THE TEXAS ICE MANUFACTURERS ASSOCIATION AND THE FLORIDA ICE MANUFACTURERS ASSOCIATION.

.·. FEBRUARY, 1894 .·.

RATES OF SUBSCRIPTION.

IN ADVANCE, POSTAGE PREPAID.

United States, Canada and Mexico, - - - - - $2.00 a Year
All other Countries, - - - - - - - - - 3.00 "

Single copies 25 cents. Advertising rates on application to the offices. Remittances must be made by post-office orders, postal notes, international money orders, checks or drafts on New York, Chicago or London, payable to H. S. RICH & Co.

H. S. RICH — S. P. FOWLER — J. F. NICKERSON — JNO. GLENN COLLINS

H. S. RICH & CO.

PUBLISHERS,

177 La Salle St., Cor. Monroe, CHICAGO. — 206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

*** ICE AND REFRIGERATION, at the World's Columbian Exposition, received a medal and diploma for editorial, typographical and artistic excellence—the highest award given to any trade journal at that Exposition.

*** ICE AND REFRIGERATION is issued promptly on the 1st of each month. The first advertising forms go to press on the 20th, and the last on the 27th or 28th. Changes in advertisements should be sent in before the 20th.

INDEX TO ADVERTISERS.

AN ICE LANDSCAPE.

The verdure of the plain lies buried deep
Beneath the dazzling deluge; and the bents
And coarser grass up-spearing o'er the rest,
Of late unsightly and unseen, now shine
Conspicuous, and in bright apparel clad,
And fledg'd with icy feathers, nod superb.—*Cowper.*

FORTHCOMING MEETINGS.

THE annual meeting of the Southern Ice Manufacturers' Association (O. T. Booz, Pittsburg, Kan., secretary), was set for April 10 (second Tuesday), and will be so held unless further information is published. It is possible an earlier date may be selected.

The fifth annual meeting of the Southern Ice Exchange will be held in Knoxville, Tenn., on February 12, 1894. C. F. Sugg, secretary. Mr. W. S. Ware, of Jacksonville, will represent the Florida Ice Manufacturers' Association at this meeting.

The ninth annual convention of the Western Packers' and Canning Association will be held at the Sherman house, Chicago, on February 13, 1894.

The Florida Ice Manufacturers' Association's annual meeting will be held at Sanford, Fla., on March 14.

The Connecticut Ice Dealers' Association annual meeting will be held at Waterbury, on March 22.

EFFECTS OF LOW TEMPERATURE.

PROF. DEWAR is making steady progress in his wonderful discoveries of the effects of low temperature on the elements, the cable informs us. He gave the result of his recent experiments in a lecture at the Royal Institute lately. A table was covered with many flagons of liquid air enveloped in carbonic acid snow. He said he had proved that at an absolute zero all metals have the same degree of conductivity to electricity, however much they may differ at higher temperatures. Prof. Gladstone's theory of the refractive indices of gases had been perfectly confirmed. He found that a low temperature greatly increased the strength of metals. Iron at — 180° C. had twice the cohesive power as at an ordinary temperature. A fully saturated magnet was found to have its power greatly increased by a reduction to — 180 C. Intense cold has a strange effect on color. The professor sponged a scarlet card painted with mercury and iodine with liquid air, and the brilliant scarlet changed to orange, but recovered its original tint immediately it got warm again. Many brilliant experiments were made by sending electric discharges through exhausted glass globes. All the well known phenomena of phosphorescence ceased as soon as intense cold was applied. Electricity tried to pass by any route rather than through the globe. What did this mean? said the professor. Obviously that something was now frozen out which had before enabled electricity to pass across vacuous space.

ANSWERS TO CORRESPONDENTS.

RE-USING CONDENSING WATER—PIPING STORAGE ROOMS—SIZE OF ICE MACHINE.

[This department of ICE AND REFRIGERATION is conducted for the benefit of the trade generally, as well as individuals; and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

RE-USING CONDENSING WATER.

To the Editor: Has there any effort ever been made, especially in localities where water is scarce, looking to the abstraction of the heat from the water of condensation and its re-use for condensing purposes? Take the water after it has gone over the steam condenser of an ice machine, which usually attains a temperature of about 130°, could not this water be cooled down to the temperature of the atmosphere by pumping it up into a tower, say 150 feet high and spraying it down that distance? Would the water not be reduced to the temperature of the atmosphere, influenced, of course, by what wind might be blowing? This tower would be constructed allowing a free circulation of air, but at the same time shutting out the effect of the sun rays. Do you think it would accomplish the object sought for?

A. S.

ANSWER.—The effort to which you refer in your letter has indeed been made, and quite successfully, as we are credibly informed. It is done on a similar principle to the one proposed by you, although the tower does not need to be nearly as high as you propose, to cool the water not only to the temperature of atmosphere, as you say, but even considerably below that. The latter effect is due to the evaporation of the water by being exposed to a draft of air while running over so-called gradirworks, such as are frequently used for the concentration of salt brine. The particular apparatus we refer to is in use at the ice works of the Anheuser-Busch Brewing Association, in St. Louis, cooling the steam condensing water for a 600-horse power compound condensing engine of their 500-ton refrigerating machine. Several apparatuses of the same kind, ordered by other large firms, are, we understand, in process of construction by their manufacturers, Messrs. A. Ruemmeli, Hacker & Co., of St. Louis, who own the patent for these gradirworks for the United States. We inclose a copy of their circular for additional information.

PIPING FOR ROOM.

To the Editor: Can you give me the proper amount of 1-inch pipe to cool a room 20 × 10 × 10 feet to 32° or 35° F., brine at 15° F.? The room is insulated with charcoal and dead air space.

D. C. C.

ANSWER.—The quantity would be 250 and 200 feet, respectively. However, a safe practice would be to exceed this quantity from 10 to 20 per cent, so that there would be no question as to the efficiency of the pipe system. You say that the room is insulated with charcoal and dead air spaces. We presume that this applies to the wall and ceiling only. If the floor is insulated by dead air spaces, then the quantity above given is ample.

STORING ICE.

To the Editor: We have seen several articles on storing manufactured ice in your valuable journal. About all of the writers on the subject recommend the use of thin strips of wood or chips between the cakes to keep them from freezing together. We are preparing to store some ice, and wish to know whether it is advisable to use the strips of wood when packing the ice away for summer use (after being in the receiving room for a day or so) or is it meant only to use said wood while ice is in receiving room, and just after it is drawn? We thought that it would be much colder just after drawing than after it has been in receiving room for a while.

T. H. D.

ANSWER.—While there is some difference of opinion on this subject, in the main the best practice recommends the use of strips between layers of manufactured ice in the storehouse, each cake being separated, top, side and bottom, from all others in the house. Just why, does not appear, perhaps, but as a matter of fact theory manages somehow to break down before the fact that those who have most successfully stored manufactured ice "strip" it in the house. This costs but little, can do no harm, and in nine cases out of ten it pays.

SIZE OF ICE MACHINE.

To the Editor: In your December issue you answer a question as to "size of machine," and give as your answer "A 20-ton machine with a brine tank 12×10×10." Will you please explain how you arrive at that figure (20-ton machine)? I have worked it out according to the American and English standards, and cannot get the result you do.

S. H.

ANSWER.—In answering the question in December issue of ICE AND REFRIGERATION, page 402, on size of machine for certain store rooms, two distinct objects are to be taken in consideration; first, that of keeping the rooms cool, and second, that of cooling the meat.

The first item amounts to the refrigeration in total of about 23,000 cubic feet, and allowing that fifty calories must be abstracted for every 1,000 cubic feet in twenty-four hours in order to keep the temperature required, we have

$$\frac{23{,}000 \times 50}{284{,}000} = 4.05 \text{ tons}$$

284,000 being the calories of heat abstractable by a refrigerating capacity equal to the melting of one ton of ice.

The second item, viz.: The cooling of the slaughtered meat, say from 80° down to 30°, may be arrived at as follows:

Weight of 20 head of cattle	14,000 pounds
" " 100 hogs	30,000 pounds
Total	44,000 pounds

Average specific heat of meat according to Siebel, 0.70. Then we have the heat to be abstracted equal to

$$\frac{44{,}000 \times 0.7 \times 50}{284{,}000} = 5.4 \text{ tons.}$$

Under the conditions assumed in the answer as given in our December issue, this refrigerating effect has to be produced in ten hours, consequently the machine should have a capacity of

$$\frac{5.4 \times 24}{10,} = 12.96$$

or say thirteen tons.

The total refrigerating capacity required for the whole plant is therefore,

$$13 + 4 = 17 \text{ tons.}$$

To give an even figure and in order to be on the safe side, and allowing for emergencies, etc., we recommended a 20-ton machine to do the work. In case the meat should actually be frozen, a much greater refrigeration would be required, but as this would not be required to be accomplished in ten hours, it is not necessary to consider this point further here.

—The Wagner Lake Ice Co., Sandusky, Ohio, has brought suit against the Baltimore & Ohio railroad for $4,088.34 for ice furnished.

—The Polar Ice Co., Augusta, Ga., has closed down, and the property will be sold at auction February 6, for state and county taxes, and for two years' water rent due the city. The factory is valuable property, but the company sustained a severe loss several years ago, from which it never recovered, when the foundation of the raceway caved in, the cost to repair which amounted to about $15,000.

THE ICE TRADE

IMPURE ICE QUESTION.

THE health officer of Ashland, Wis., advised the council of that city to pass an ordinance requiring the ice cutters to go out three-fourths of a mile in the lake for their ice, and one mile from any sewer, applying the rule that is enforced in the case of the water company. Mr. Lang, of the Associated Ice Co., suggested that the best way to test the purity of ice is to analyze it, to which the doctor responded that would not help the case any for this winter. The ice company has already put in about 2,000 tons, and both sides are desirous of having the matter settled definitely at once, and for that reason the city attorney was asked to draw up an ordinance governing the case, and the council thereupon passed the same under suspension of the rules. At West Superior, in the same state and neighborhood, the ice men are required to go out at least 2,000 feet from shore. A movement is on foot in the interest of the brewers and other parties of West Superior to have the ordinance prohibiting the using of ice cut from the bay changed, so that cold storage people, by giving a bond to use the ice only for cooling purposes, will be permitted to cut their ice where they may see fit.

THE latest was the discovery (?) that the Kennebec river ice is "infected" with sea salt. This charge rather surprised the natives along the river who had been heedlessly drinking the water with a reckless abandon possible only in a state "gone dry" these fifty years; but as "everything goes" as impurity nowadays, the ice (that is, some of it) was sent to Boston for analysis, and the river held its breath for the verdict. The "Bostonnais" pronounced it pure, and as all the world began to stir when the prince kissed the Sleeping Beauty, doncher know, so the 1,300 men and horses on the Kennebec then waked up and went to work again!

Now when things get to that impossible stage of the game in which they appear to be at Easton, Pa., the question becomes, of course, "Ice, or is it Ice?" The local medico-editorico says with sober sobriety which would seem consistent with his well known sunniness of temper that—"Undoubtedly a great many impurities are frozen up with the ice and afterward undergo chemical changes in the ice cooler. If the same changes took place in the river the poison would be more diffused and the water rendered less noxious. The old argument that Easton used natural ice for decades and is still here amounts to nothing. It did a great many other unwholesome things during the same years and attributed the results to other causes which it would not do again. Poison is never counteracted by prejudice." Now, if things get much worse at Easton, we shall expect to hear of the population is taking to what Mr. Richard Swiveller would denominate "The Rosey."

STOCKS AND PRICES.

——Peoria, Ill., is said to have enough last year's stock on hand to carry the trade of next summer.

——The Mt. Gretna Ice Co., Lebanon, Pa., have enough of last year's ice on hand for next season's trade.

——Dayton, Ohio, dealers are said to have enough stock to carry them through next season without a harvest this winter.

——The United Ice Line Co., at Elizabeth, N. J., are credited with having 40,000 tons of last year's ice in the houses at Greenwood lake and elsewhere.

——Fred Jaeger, Columbus, Ohio, has a good supply of ice over from last year, and is now wholesaling some of it. The East Side Ice Co., of the same city, has a good supply of ice, but hardly enough to last out the season unless they can replenish it this winter.

——The Yates Ice Co., Kansas City, has 15,000 tons of ice left over out of 65,000 tons harvested last year, but this, with all the machines can make, will not supply the demand. The Yates company used 30,000 tons last summer. No ice men have yet made any preparations for going north to gather crops, and won't till about February 10.

——"Spokane uses from 5,000 to 8,000 tons of ice each year," said one of the ice dealers of that city recently. "Last year the trade was poor, being about two-thirds the usual amount, and we had a great deal left over. We sell it at all prices from $5 to $15 per ton. Butchers are paying $5 per ton at this season. With four companies in the field, there may be a fair margin of profit for careful management, but there isn't a fortune in it for anybody."

——The Toledo trade is now selling ice at $2.50 a ton in load lots. The price ranges from 12½ up to 15 and 20 cents per cwt. If no local ice is cut, the price will advance from 50 to 75 cents a ton. At Monroe, Mich., a Toledo source of supply, the speculators are rushing for the lakes and paying $50 or more bonus for locations. If the ice is used they will make a little out of it, and if it isn't used they are $50 to $100 out, or whatever they have paid for their privilege.

——Newark, N. J., has no apprehension of an ice famine; for it is estimated that there are in the Hudson river ice houses about 1,000,000 tons of ice, at Greenwood lake 30,000 tons; at Echo lake 40,000 tons. The Yonkers City Ice Co. has about 90,000 tons stowed away; and the Knickerbocker Ice Co., of Philadelphia, it is said, has half of its last year's crop, which amounted to 1,000,000 tons. Then there are numbers of full ice houses on the Kennebec and Penobscot rivers. Mr. Drake, a leading wholesaler, said, January 11: "I do not think there is the slightest possibility of an ice famine. People go into ice cutting now for an investment. They build big houses and store ice to hold for short seasons. I have bought ice down in Maine that has been held this way for nine years. People can depend on it that rates will be higher next season than last, however. Last year I sold ice at the houses for ten cents a hundred. I expect that butchers and store keepers will have to pay thirty to forty cents off the wagons next summer."

FIRE AND ACCIDENT RECORD.

——The ice house of C. M. Conrad's brewery was burned January 12; loss, $1,500.

——O. C. Whitney's ice house at Heart Lake, Pa., was burned January 11; insurance, $5,000.

——The ice house of the Kurtz Ice Co., Kenosha, Wis., was burned December 20; loss, $15,000; insurance, $3,000.

——The ice houses of D. Whiting & Sons at Wilton, N. H., were burned January 5; loss, $4,000; insurance, $1,100.

——Two ice houses at Franklin, Ohio, the property of Dr. R. P. Evans and Dr. O. Evans, were burned January 19.

——The ice house of the Huse & Loomis Ice and Transportation Co., St. Louis, was burned December 26; loss, $10,000; insured.

THE month of December promised an exceptionally abundant crop of ice, if December conditions should prevail through January; and this seemed probable at the date of our last writing for the January ICE AND REFRIGERATION. However, the holidays were followed by a thaw—not exactly the old-fashioned "January thaw," with rains, floods and departing ice, but "soft" weather which, beginning in the West, worked slowly eastward, leaving in its wake ruined ice which before January 1 was nearly ready to go into the house. From about this date up to January 24 there was but little freezing weather in the Northwest, except in the more northern sections. However, the ice went to pieces slowly, and from all parts of the country we have reports of the harvest of considerable thin ice (three to nine inches) prior to the 15th, by which time, except in the extreme north, the ice had collapsed. Of the ice housed, however, little had been secured by the great city companies, who after the 15th began deserting the local fields, and pushing further northward. On the 24th the mercury dropped all over the Northwest to several degrees below zero with a plunge, and "ice making weather" came with a rush, the "cold spell" being preceded, however, in the West by a few inches of snow. The storm worked to the eastward, and though after the 26th the cold had moderated, good freezing weather still remained up to this time (29th). The prospect for ice is, therefore, at this writing quite promising.

MISSOURI has done practically nothing in the way of a harvest. No ice has been cut at Kansas City for any purpose, and none at Leavenworth or any of the cluster of big towns in that neighborhood.

MINNESOTA had good ice up to January 16, when the thaw came. Duluth had cut no ice up to that date, but other towns had done better, reports from St. Cloud, Winona, Mankato, Red Wing, etc., all indicating that the harvest had begun prior to January 15 and that the crop for those towns at least, as well as many lesser places, is substantially housed.

WISCONSIN, generally speaking, has done fairly well so far. The chain of lakes in the southeastern corner of the state on the North-Western and Wisconsin Central roads, whence a large part of Chicago's domestic ice is brought, have not been as busy as usual, and several of the big Chicago companies have had to look to fields farther north; but Madison, a favorite field which got such a "black eye" last year, when there was ice everywhere, has been particularly favored this season when ice fields are at a premium. In fact, at every available field in the state there has been active inquiry from southern points: St. Louis, Indianapolis, Louisville, etc., and this inquiry has reached as far north as Superior, where considerable ice was cut for shipment south prior to January 17. After that date for a week at least soft weather interfered materially with the harvest.

INDIANA and Ohio, up to January 20, had cut practically no ice, and the crop is looked upon as a failure.

MICHIGAN has housed very little ice, although north of Grand Rapids fair to good ice was ready for cutting prior to January 20. The Detroit companies had cut no ice at home up to the 20th, and Grand Rapids was similarly situated, as were the other leading cities of the state.

PENNSYLVANIA is quite as badly off as Ohio. Early in the month there was ice through the state, but not thick enough to cut. The weather since has made but little ice, which in the latter end of the month was not as good as it was earlier.

NEW JERSEY has cut no ice, though early in the month 6-inch ice had formed near Paterson and three inches thick on the Newark fields. Some of the Newark dealers gave up hope of a local crop and have gone to northern New York.

NEW YORK state has made only a little marketable ice except in the neighborhood of Saratoga. The Hudson has yielded none, although the empty houses have been ready since January 1. Late in December the prospect in the state was fair to good, but later a thaw came; then another short freeze, which, while it made some lake ice, rather injured than benefited that on the Hudson. Buffalo, Rochester and the larger interior cities are waiting for another freeze.

THERE seems to have been plenty of ice in New Hampshire and Vermont, although little appears to have been cut on Lake Champlain. The harvest (40,000 tons) at Manchester, N. H., began January 15.

CONNECTICUT and Rhode Island started in the year with a fine prospect, but the crop would not grow; and by the 23d the ice had only reached a thickness of four to five inches, in some places nine inches. Of the latter sort considerable was cut. When, however, still milder weather came, January 24, the outlook began to seem very unpromising, not to say discouraging.

MASSACHUSETTS seems to have been able to house a good crop—enough with what was held over to carry through the coming season. The ice is not quite so good as last year, perhaps, being neither so thick nor as free from snow; but it is good enough, and as early as January 18 it was felt by the Boston dealers that they would have no trouble in getting all the ice needed.

MAINE has plenty of ice. The question at issue there is not a lack of ice, but how is the rest of the country coming on? A large amount of ice is held over, and some ice has been cut this year, but not so good in quality as last year's nor harvested as cheaply as that crop. The main point is, what is the prospect as to prices? If, as last year, all the world has plenty of ice, the cut in Maine would be largely lost labor. But if the Hudson river crop should fail, the ice on hand in Maine (now worth seventy-five cents) would be valuable, and the apparent shortage could be made up on short notice. Comparatively speaking, the harvest has been short up to date.

REPORTS from Reno, Nev., from which district much of the ice used in California is taken, say, January 7,

that—"this has been one of the very best years for the ice men. So far they have harvested their ice crops at a nominal cost.

ALTHOUGH by January 1 but little ice had been housed at E. Las Vegas, N. M., and this little only four inches thick, there was still no doubt about a crop. The local paper says. "The ice crop here never fails, no matter how warm it is, and we do not have to pray for severe weather in order to get our congealed luxury. While only 4-inch ice has formed at Santa Fe, and but little of that, Las Vegas has had an abundance of 12 and 15-inch ice. Yet the weather reports show that during the month of November the average temperature at Las Vegas was 40°, or 1.6° warmer than it was in Santa Fe, and December, no doubt, will show an equal or greater difference in favor of this city. Las Vegas has the most wonderful ice fields, probably, in the United States, where excellent ice forms, though the town, seven or eight miles away, is enjoying semi-summer weather."

FROM THE HARVEST FIELDS.

——Gen. O'Neill, Prescott, Ariz., cut 6-inch to 11-inch ice on his ponds, January 12.

——January 19 ice cut at Cheyenne was twenty inches thick, and a big harvest was in progress.

——Up to January 11 the health office at Denver had issued no permits to cut lake ice for use in that city.

——At Spokane, Wash., up to January 19 the trade had been able to get in but two days' work on 9-inch ice.

——On January 15 Grant Rivenburg had filled his houses (3,000 tons) at Santa Fe, N. M., with "first-class" ice.

——The Wyoming crop is about all in—Rawlings having housed its supply (1,000 tons) before January 15, and that for Laramie (1,000 tons) was in a few days earlier. The amount cut at Laramie for outside towns amounted to nothing this year.

——Salt Lake City reports, dated January 13, say: "The ice season has opened up with an unusually brisk business this year. Extensive shipments of what is called Park City ice are being made. This ice is really from several miles below Park City, and is shipped by the company whose office is at the last named place. The Utah Central railway is now hauling to this city ten to twenty car loads daily. The ice is of the very best quality. From present indications there is no likelihood of a scarcity in the cooling substance next season."

NATURAL ICE NOTES.

——A new 700-ton house is building at Champaign, Ill.

——James Sterling has built an ice house at Raglesville, Ind.

——Rufus Lyman has built a second house at Southampton, Mass.

——F. A. Cadwell has enlarged his house at East Amherst, Mass.

——John Dietze has built a 5,000-ton house at St. Charles, Minn.

——C. Corbin has built an ice house at The Cliff, near Moline.

——The B. & O. R. R. is building ice houses at McMechen, West Va.

——De Money & Harrington have built an ice house at Genoa, Neb.

——Earl Prior has built and filled an ice house at Cambridge Junction, Ill.

——S. P. Kettering has built an ice house at Sharon, Pa., for his retail trade.

——W. W. Nelson and E. H. Taft have built ice houses at Mendon, Mass.

——The Jefferson Ice Co., Chicago, has leased ice privileges at Madison, Wis.

——M. J. Minor, Galena, Ill., has built a large ice house at Mineral Point, Wis.

——The Grant Ice Co. are improving their city plant, at Grand Rapids, Mich.

——The Hilt Ice Co., La Porte, Ind., have built several new houses on Clear lake.

——The Washington Ice Co., Chicago, is enlarging its buildings at Fort Atkinson, Wis.

——Mr. Walkup, at Anaconda, Mont., filled his houses with 14-inch ice before January 14.

——The Hygeia Ice Co., Boston, has built a 1-story ice house, 196×60 feet, in the city.

——Noble Robin and Hiram Smith are building ice houses on Mazon creek near Morris, Ill.

——Chas. Deuterman & Sons are building near White Plains, N. Y., a house to hold 8,000 tons.

——Geo. W. Parmenter is to put up steam hoisting machinery at his houses at Montpelier, Vt.

——A. Ralthoff has leased the plant of the Crystal Ice Co., Roanoke, Va., for a term of years.

——Perring & Martin, Rantoul, Ill., have built a new ice house, to be filled from Wisconsin.

——Mr. Baker, at Urbana and Champaign, Ill., has added storage for 700 tons to his ice houses.

——The ice harvest at Grand Junction, Colo., began January 9, with a prospect of a large crop.

——A. A. Tilley has built an addition to his plant 100×30 feet, increasing his capacity 50 per cent.

——Levi Booth's men at Ottawa, Ont., Canada, struck for 50 per cent increase in wages January 16.

——The Chicago & Grand Trunk has repaired its plant at Vicksburg, Mich., and will fill all its houses from that point.

——S. T. Gilliland owns the ice cutting right of the water reservoir at Van Wert, Ohio, and has built a new storage house.

——The Wallum Pond Ice Co. is building at Pascoag, R. I., an ice house 186×182 feet, which, when finished, will be duplicated.

——Griffin & Connelly, Chicago, have built an addition to their house at Palmyra, Wis., 50×200 feet, 36-foot posts, to hold 25,000 tons.

——Reports from Kansas about the middle of January say that unless cold weather comes later, the crop of that state will be a failure.

——The Brown Ice Co., Louisville, Ky., has leased ice cutting privilege at Oshkosh, Wis., from which it is hoped a crop may be harvested.

——The Consumers Pure Ice Co., Chicago, in overhauling their compression machines recently, repacked the rods with the "Swain" metal packing.

——The Augusta Ice Co., Augusta, Me., has been organized for the wholesale and retail business; O. C. Webster, president; S. C. Wheeler, treasurer.

——It is said the Saddle River Ice Co., Paterson, N. J., is to be reorganized, with Sheppard & Knapp, carpet manufacturers, New York, as principal promoters.

——The K. C., Ft. S. & M. R. R. Co. has built a large ice house at Springfield, Mo., the roof of which is fire proof. The ice will also be fitted up for the icing of refrigerator cars.

——J. A. Campbell & Co., Menominee, Mich., are building an ice house to cost $15,000. We are informed that "six carpenters and one painter will have steady work during the winter in finishing it off; and that, as an extra attraction, the sides of the building will be decorated with arctic scenery."

——The New Haven (Conn.) Ice Co., whose storehouse at Lake Whitney was burned last summer, has just completed a fine new building on the site of the old ones. The structure is of frame, 80×175 feet, and has a capacity of storing 10,000 tons of ice. The walls are packed with sawdust, and the building is divided into five sections. The building has the latest and best equipment by way of ice harvesting machinery. The endless chain arrangement for lifting the ice is inclosed instead of being exposed. When the ice reaches the top it is slid along a shute which runs past on a straight incline along the entire length of the building. At each section there is a shaft and automatic lowering device. The blocks of ice are delivered to each section in rotation. At each shaft is stationed a man who stops the block and shoves it into the shaft. The car drops immediately to the layer of ice below, dumps the block and returns to the shute above. In this way the ice is packed very rapidly.

——New small houses have been erected since December 1 by J. H. Wade, Milton, Me.; Samuel King, Waterville, Me.; Lull Bros., Newport, N. H.; W. F. Wiefley, O. H. Powers, T. Berry, Young's Creek, Mo.; Benj. Hayes, Hammond, Ind.; for Lake County Agricultural Society; Pekin and Spring Lake Hunting and Fishing Club, of Pekin, at Spring Lake, Ill.; Kiefer & Hasbrouck, Hazleton, Iowa; Dennis Kelleher, Brockton Heights, Mass.; E. R. Case, Frenchtown, N. J.; John Perry, Clark's Falls, R. I.; Alfred Rudals, Essex Junction, Vt.; Brice Ryker, Branchville, N. J.; Dr. C. O. Boyden, Bridgewater, Vt.; E. Newport, King street east, Hamilton, Ont.; H. M. Holly & Son, creamery, Port Jervis, N. Y.; A. T. Keele, Carlinville, Ill.; Farmers' Creamery Co., Walworth, Ill.; Chas. H. Brown, Wyoming, R. I.; Herbert Whitney, New Canaan, Conn.; L. H. Pease, Edgartown, Mass.; Jos. Brockway, Hadlyme, Conn.; Crystal Ice Co., Brockton, Mass.; Mr. Husman, Natrona, Ill.; H. A. Parsons, Readsboro, Vt.; Jos. Womochel, Musserville, Iowa; Woodward & Burnham, Chaplin, Ill.; Louis Kellerman, Kingston, N. Y.; A. P. Limeburner, Modena, N. Y.; W. H. Ross, Billings, Mont.; Betz & Love, Pearl City, Ill.; E. A. Coggeshall, Portsmouth, R. I.; Abbott Craig, West Farmington, Me.; Chas. Schaller, Onalaska, Wis.; W. A. Brown, Jacksonville, Vt.; O. E. Aber, Beaver, Pa.

THE curiosity of the season is the concerted attack (with their mouths, in the papers) by health officers, several doctors, "anti-monopoly" newspapers and all that tribe, upon the dressed beef sold in San Francisco by the recently erected packing house at Baden. The ground of the attack by these long-eared worthies is that the beef, *because it is cooled in a mechanically refrigerated cooling room*, is unwholesome! One "Dr.," who by some strange and fitful fate of circumstance, is a member of the board of health, says, with owlish wisdom of rare composition: "Meat put at once into cold storage, with the animal heat in it—alive, I might say—is likely to go to pieces when exposed to the air; in plain English, to rot. Such meat is, of course, utterly unfit to eat, and the person who does eat it is bidding for an attack of cholera-morbus. That is my opinion of Baden beef in a nutshell, and I want the public taken into my confidence." A certain eastern millionaire, it is said, used to be looking for the fellow who could be "more kinds of a d—— fool" than his son-in-law. One wonders how this "Dr." in 'Frisco escaped his observation.

PACKING HOUSE NOTES.

——The Dold packing house at Wichita was reopened January 5.

——The National Beef Co. will erect a cold storage house at Duluth, Minn.

——The Swift Packing Co., Chicago, is building an ice house on Lake Waubesa, near Madison, Wis.

——Jacob Moschel has placed a 5-ton "Case" refrigerating machine in his meat market at Buffalo, N. Y.

——Poschinger & Nevian, Louisville, have purchased a Sulzer-Vogt refrigerating machine of 60-tons capacity.

——The work on the two ice houses which are being built at McMechen, W. Va., by Swift and Armour, are completed.

——Indianapolis packing houses, November 1 to January 12, slaughtered 160,000 hogs against 107,000 for the same period last year.

——Jacob T. Alburger & Co., Philadelphia, packers, have bought a 35-ton "Boyle" machine, made by the Penn. Iron Works Co.

——The G. H. Hammond Co., Hammond, Ind., is making arrangements to ship a large force of men to northern Wisconsin to harvest ice.

——Chas. C. Pfluger, pork packer, Washington, D. C., has purchased a refrigerating machine from the Remington Machine Co., Wilmington, Del.

——Armour & Co. notified the laborers employed at their packing houses January 9 that their wages would be cut from $1.75 to $1.50 per day.

——On January 16 the Armour Packing Co. formally opened the new cold storage warehouse constructed in Winona, Minn., at a cost of $16,000.

——At Indianapolis, Kingan & Co. in January killed 5,000 hogs daily; Moore Packing Co., 1,000, and Coffin & Fletcher, 700 per day, making a total of 6,700.

——Powdermaker Bros., agents for Swift & Co., Wilmington, Del., have put in a Remington refrigerating machine for cooling their plant. It will be run by electric motor.

——The Cudahy Packing Co., of South Omaha, Neb., has made a contract with the Vilter Mfg. Co., Milwaukee, for one complete 150-ton refrigerating machine plant.

——Aaron Hammond's cold storage warehouse, at Spencer, Mass., is completed. The building is 70×30 feet on the ground, one story high and has a capacity of thirty-eight head of cattle.

——The Minneapolis salesroom of the Cudahy Packing Co. was opened to the public January 5, when a luncheon was served to some 800 guests. The cooler has capacity for 400 quarters of beef.

——The Schrander Packing Co. has been reorganized, and was incorporated with a capital stock of $25,000, by John Schrander, Christian Foehr, Jacob Ziegler, William Pister and Frank L. Pfaff.

——Reid Bros., packers, who have recently made several additions to their plant at Kansas City, have completed arrangements to add a department, in which they will manufacture soups and bouillon.

——The Abattoir company, at Hamilton, Ohio, which is a branch of the two Cincinnati houses, is now completed and ready for use. No cattle will be killed here, and the place will be used entirely for cold storage purposes.

——The pork packing house at the St. Joseph stock yards has been sold to Anderson Fowler, P. L. Underwood and James Viles, Jr., of Chicago. The new owners will take possession February 1, and will enlarge the house.

——The G. H. Hammond Co. has let the contract for the construction of a pork house at Hammond, Ind. The structure will be of stone and wood and the dimensions 60×400 feet. The improvement will cost between $25,000 and $50,000.

——The stockholders of the Denver (Col.) Packing Co. held their annual meeting January 10, and elected the following directors and officers: William J. Wulff, president and treasurer; Fred Walsen, vice-president; H. L. Luckenbach, secretary; James Gibbons and F. J. Gibbons.

——The 60-ton Hercules machine shipped January 3, to the Natural Ice Skating Co., San Francisco, was received there on January 12 to 15, and was erected and was running by January 23. The rink (the first permanent rink in the United States) opens for business February 1; W. N. Donaldson, general manager.

——The Moore Packing Co., of Indianapolis, was incorporated January 18; capital, $250,000. The directors are Samuel E. Rauh, Michael Sells, George C. Beck, Cortland VanCamp, W. H. Coleman, Henry Schurmann and D. W. Marmon. The plant will be located in West Minneapolis. The company proposes to pack meat.

——The Nashville Packing Co., Nashville, Tenn., have slaughtered more than 12,000 head of cattle and hogs since the packing house was opened, November 22. The company is killing about 500 hogs daily, and would increase the number to 1,500 if stock enough were sent in. The management are well pleased with the progress thus far and the outlook.

——January 20 a decision was rendered at Memphis, Tenn., in the case of Kingan & Co. against the city, which announces that the $250 license tax exacted from outsiders for the privilege of selling meats in that city, is in "direct interference with interstate commerce, and therefore unconstitutional for the reason that the complainants butchered no meat in this state, and simply whosaled their products to butchers there."

——By mutual consent of the interested parties, the United States circuit court at Kansas City made an order December 29, releasing the packing house portion of the St. Joseph Stock Yard and Terminal Co., to the Omaha Packing Co., which recently made an offer to operate the packing house in consideration of receiving $125,000 worth of the company's stock. The release ordered carries ten acres of land with the packing house.

——The packing house at Houston, Tex., with a daily capacity of killing 500 hogs and 300 cattle, was purchased last year by men who are strong both financially and in experience. It is now running full time, shipping its products to Colorado, New Mexico and the Atlantic seaboard. Industries utilizing the incidental products of the packing house, such as soap, pepsin and fertilizer factories, etc., are now arranging to enter into active business.

——Two attempts had been made up to January 9 to fire the packing house of J. M. Doud & Co., Boone, Iowa. The first was discovered before any damage was done. William Martin was arrested the next morning charged with the crime and is now in jail awaiting the action of the grand jury. At the second attempt the sheds and adjoining buildings were fired. The incendiary was seen but not recognized. The fire was extinguished before more than $500 loss had been entailed.

——Hereafter, in accordance with the order of Secretary Morton, of the agricultural department at Washington, which went into effect January 2, the microscopical meat inspection departments in Kansas City will be confined strictly to orders for pork for exportation to countries which demand that kind of inspection. Only a few inspectors are employed in that city, the force having been reduced from sixty microscopists to twenty-five. It is expected that, owing to the new order, the expense of operating the government inspection bureau will be much less. The microscopists retained will be required to be ready at all times to inspect export pork. The Armour Packing Co. claims that Germany and France, as well as other foreign countries which demand microscopical inspection of pork, are increasing their orders for pork, and that as long as prices are satisfactory they will be heavy buyers. For this reason it is thought that there will still be considerable work for the inspectors in the future.

——The New York Condensed Milk Co. has purchased three more "Remington" refrigerating machines, to equip three additional factories, in the same way as the Wassaic factory is refrigerated.

TRADE CORRESPONDENCE.

GASES IN ICE MACHINES—THE ICE TRADE IN JAPAN—CARBONIC ACID MACHINES.

[The publishers of ICE AND REFRIGERATION do not hold themselves responsible for the opinions expressed by correspondents on any topic; but these columns are at all times open for the discussion of subjects of interest to the trade, and such correspondence is at all times welcomed. Our readers are cordially invited to contribute to this department by giving their views on questions propounded, or by suggesting original topics for trade discussion, or notes on the condition of trade in their section of the country. Anonymous letters will receive no attention whatever.—ED.]

GASES IN ICE MACHINES.

To the Editor: In the November number of ICE AND REFRIGERATION some letters were given in which the writers expressed their opinion regarding the cause of the production of gases in ammonia absorption machines. This is a subject on which I have been looking for information for some time past, and am pleased at receiving some light on the matter. In the December number an article on the same subject gave some very explicit reasons for the occurrence of gases and the means whereby they can be removed from the system. It appears that there are two gases produced, and that when they are present the efficiency of the system is impaired. If the writer of the last article had told us that the decomposing temperature of ammonia, which he gave, was the result of actual practice, I, for one, would have more confidence in the statement. But we know that gases do form in ammonia systems, and are satisfied with a reasonable explanation of how they get there.

I notice that Mr. Starr found in his investigations that there was more hydrogen present than could be accounted for by supposing that it all came from the ammonia. I would like an explanation of how that could be. He says: "If it is hydrogen, and comes in large quantities and keeps coming, look to the coil in the still"—which would indicate that he thinks it results from the decomposition of water, and that it was caused by electrolysis. The subject is of importance and deserves a careful investigation.

There are a few points which come up in practical experience with ammonia machines that we would like to understand better; and I shall always be thankful to the person who gives me a practical pointer on any of these subjects. I have met with certain troubles in the plant that I have charge of, and have worked out a solution of nearly all of them. At some time in the future I will try and return the compliment and give pointer for pointer by describing some of these troubles and how I overcome them.

I think the addition of the new department, "The Engine Room," will make a valuable feature of your paper and commend it most highly to the men whose business it is to look after the machines. I was much interested in the letter from Mr. Luhr, and hope he will keep his promise by giving his views on piping the different rooms about a refrigerating plant. In several cases I have noticed that there was not sufficient cooling surface to do the work as rapidly as was desirable; but as I was not sure as to the economy I have not added any more pipes, but will make a change as soon as I can get the opportunity. I hope the men in the engine rooms will write more letters describing how they handle their plants, for an exchange of information on the subject will be of benefit to all of us. G. W.

CHICAGO, ILL., January 10.

THE ICE TRADE IN JAPAN.

To the Editor: We herewith give you a short outline of last year's ice trade here. As we observed in your December number, it was in many respects similar to conditions in some of the states. A large amount of ice was gathered here from the rice fields lying at the foot and north side of hills. As this ice is very thin and never clean, it is mostly used for packing; but in many cases from its cheapness it is used also by the natives for drinking purposes. Another supply of ice is obtained from the north, in the neighborhood of Hakodate. This is sometimes clear, and from ten to fifteen inches thick. Last year the crop from both those sources was so abundant that our manufactured ice was only required by the foreign population of this place, the hotels and hospitals, for their use on table or for medical purposes. Our ice is made very clear, and from the service water here, which is drawn from the river at that point where it has not passed through any towns or villages. Yet, notwithstanding a higher price was paid for our ice than obtained by the native ice dealers, who had to sell at any price, we had to keep our works going with no profits. The plants here have been unprofitable to their several owners. The ice plants of the brewers here were mostly built in Germany. One of those machines has been kept at work a few years for the supply of ice only, but had to close up on account of the strong competition by the field ice, which was very plenty at that time.

Our cold dry air storage has proved unsuccessful, not having sufficient support, which is only on a very small scale at present.

L. STORNEBRINK & Co.

YOKOHAMA, Jan. 4, 1894.

CARBONIC ACID MACHINES.

To the Editor: Our attention has been drawn to a report in your issue of September last of Professor Linde's paper on "The Refrigerating Machine of To-day," wherein the Professor, referring to carbonic acid machines, says in a foot-note:

"The unfavorable consequences for the performance of the carbonic acid machine near the critical point, as they result from the physical facts just referred to, have been frequently denied, and cases have been pointed out in which such machines actually work with higher temperatures of cooling water" (*i. e.*, than 88° F.).

He then proceeds to explain (?) away the facts which appear to contradict his theories.

Now, when fact and theory are in antagonism, theory has to give way, and we venture to suggest that the Professor should amend his theories in view of the following hard facts:

We have for the past four years been constructing carbonic anhydride refrigerating machines, and out of some 140 machines made, no less than forty are either regularly working in tropical climates, or continually passing through the tropics, where the *initial* temperature of the cooling water is 90° F., and often above.

Now, the paragraph we have quoted above terminates thus: "The refrigerative performance of the machine is then (with water at 88° F.) based on the same principle as that of a cold air machine (with closed cycle)."

Now, we would like to know how Prof. Linde reconciles the fact that at the present time, by means of our carbonic anhydride machine upwards of half a million carcasses of frozen mutton are imported annually into England, all of which have to pass through the tropics, whereas the horse power of these refrigerating machines is only one-fifth that required by the cold air machines? We claim also to know something of the latter, having fitted them on board more than 100 vessels.

Seeing that on this point the Professor's theories have so seriously led him astray, it will hardly be a matter of surprise if your readers look with a considerable amount of skepticism upon the other theoretical conclusions he has worked out with regard to carbonic acid machines. Yours faithfully,

J. & E. HALL, LIMITED.

DARTFORD, KENT, ENGLAND, Jan. 12, 1894.

OBITUARY ITEMS.

——John Deming, president of the Deming Co., Salem, Ohio, died January 10, 1894. He was nearly 77 years of age.

——Campbell McDonald, formerly in the ice trade at Newburyport, Mass., with J. C. Tarleton, in which trade he was succeeded by his son, died at West Newbury, January 2, in his fifty-fourth year.

——Lansing M. Pittman, thirty-seven years of age, died January 4, at his home in Detroit, Mich., of peritonitis. Since 1872 he has been secretary of the Pittman & Dean Coal and Ice Co. He was married, and his widow with two small children survives him.

——William Pitt Earle died at his home in New York city, January 2, after a lingering illness. He was born at Worcester, Mass., June 14, 1812. His early life was spent in Hartford. In 1845, after a few years of business prosperity, he went to New York. He was one of the originators and directors of the Consumers Ice Co. of that city. Retiring from active business many years ago, he died leaving a large estate. His wife and four sons and one daughter survive him.

——The Union Ice Co., Pittsburgh, Pa., has been legally dissolved.

——The Schwartzenbach Brewing Co., Germania, has bought a refrigerating machine.

THE outlook for the year 1894 is, at this writing, very promising indeed. Inquiries for machinery are increasing in number, sales are by no means as "slow" as they might be; indeed, if we can trust the "signs," there is a general awakening of business which, before the year is gone, will amount to a substantial revival of this line of industry. The soft weather of the first three weeks of January has not been without its result in stimulating inquiry, even from as far north as St. Paul, Minn. Our record of new work and recent orders placed shows a decided improvement.

ARKANSAS.

Little Rock.—The Little Rock Ice Co., with plants in Little Rock and Argenta, has just completed improvements to the Little Rock plant costing $53,000, having set up a 75-ton "Consolidated" machine, built by John Featherstone's Sons, Chicago. This company's plants now make 145 tons of ice daily, the largest output west of the Mississippi, St. Louis excluded.

ALABAMA.

Mobile.—The Consumers' Ice Co. is putting additional machinery in its ice factory.

CONNECTICUT.

Hartford.—W. C. Wade is building an addition to his refrigerating plant, and has bought a machine from the Remington Machine Co.

FLORIDA.

Braidentown.—An ice factory will likely be built here.

Brooklyn.—A rumor is current that several Jacksonville parties intend to erect an ice factory in Brooklyn.

Jacksonville.—Adam & Richardson, meat receivers and factors, have bought a refrigerating machine from Westinghouse, Church, Kerr & Co.

Jacksonville.—W. P. Sumner, dealer in butter and eggs, will put in a small refrigerating machine built by Westinghouse, Church, Kerr & Co.

Jacksonville.—Guy R. Bride is erecting a cold storage addition to his ice factory.

Jacksonville.—The St. James hotel is putting in a refrigerating machine for general purposes. Westinghouse, Church, Kerr & Co. are the builders.

Key West.—The Key West Pure Ice Co. will put in an additional ice machine of twenty tons capacity daily, and will also equip a cold storage plant. Machinery has been arranged for.

Palatka.—The Palatka Ice Co. (L. C. Canova) is putting a new 100-horse power boiler in its ice factory.

Tavares.—The Peninsula Land, Transportation and Manufacturing Co. has provided in a trust deed for the erection of an electric plant and a 50-ton ice factory.

ILLINOIS.

Bloomington.—The refrigerator erected by E. Holland is now completed and will be ready for the reception of merchandise about February 1. The structure is located a short distance east of the C. & A. freight house. It will be used for the storage of beer principally.

Chester.—The Chester Light, Water and Ice Co. will put in an ice machine; and are now ready to receive bids.

Chicago.—The Western Refrigerating Co., Chicago, operating one of the largest cold storage houses in the west, have just given the Fred. W. Wolf Co., Chicago, an order for a 100-ton Linde refrigerating machine, making the third order for Linde machines for this company, who will have in its completion 300 tons of this machinery in the house.

Chicago.—The refrigerating plant at the big store of Siegel, Cooper & Co. is being enlarged and the Hercules machine recently erected there is being removed for a large one of the same make.

Chicago Heights.—A refrigerator building of modern design and equipment will be erected here. Joseph Theurer, Chicago, can give information.

Galesburg.—The Galesburg Artificial Ice Co. has been licensed to incorporate; capital, $30,000; incorporators, N. P. Glenn, Wm. H. Pearce, Lafayette Weinburg.

Mt. Carmel.—L. Kamp & Sons will put up an ice factory, and during the past month Mr. L. Lamp has been inspecting plants in operation before placing his order for machinery.

Pontiac.—The Illinois State Reform School at Pontiac, of which Major R. W. McClaughery is superintendent, has contracted with Westinghouse, Church, Kerr & Co. for a combined ice making and refrigerating plant, to cool their store rooms and manufacture sufficient ice for the school's use.

INDIANA.

Alexandria.—The Alexandria Artificial Ice Co. has purchased a 20-ton "York" ice machine, to be erected immediately by the York Manufacturing Co., of York, Pa.

Huntington.—Carl Lang, the brewer, is putting in a new ice machine, and will make ice for the city trade.

Indianapolis.—The Crystal Ice Co. is pushing work on its new ice plant.

Marion.—Spencer & Van Gorder, ice dealers, will erect a 20-ton ice plant to be in operation by April 1. They will spend about $25,000 on their plant.

New Albany.—The New Albany Ice Co. has bought a Sulzer-Vogt machine.

North Madison.—Julius Tudde, ice dealer, writes that he is going to build an ice factory.

IOWA.

Sioux City.—The Hanford Produce Co. has purchased a 50-ton Hercules machine for their cold storage plant.

KANSAS.

Coffeyville.—Harding & Gay have begun building a 20-ton ice plant here, taking advantage of the natural gas offered. The plant will stand on the right of way of the Santa Fe road. Mr. Harding is a capitalist of Fredonia, Kan., while Mr. C. M. Gay was recently manager of the very successful Carthage Ice and Cold Storage Co., Carthage, Mo.

Newton.—Several Newton men are talking of erecting a large plant here for the manufacture of ice. If they decide to build the plant it will be put up in time for next summer's trade.

KENTUCKY.

Frankfort.—The Capital City Railway Co. is negotiating for machinery for the manufacture of ice, and will have a plant in operation within sixty days.

Georgetown.—Rumor says that a new ice company will begin the operation of a plant here about the first of April.

Paducah.—A. J. Petter, 917 South Fourth street, Paducah, Ky., wants information on ice machinery, cost of same, etc.

MARYLAND.

Cumberland.—The Cumberland Ice Co. has resumed operations at its factory after a cessation of several weeks for necessary repairs. The company now intends to add a cold storage department in the near future.

Hagerstown.—It is said a new company will be organized here to build an ice factory in competition with the one now doing business.

MASSACHUSETTS.

Boothbay Harbor.—Mr. Gamage contemplates building an ice house addition to his store building, for cold storage purposes, and for the Heron island supply.

Boston.—S. S. Learnard & Co. have made a contract with Westinghouse, Church, Kerr & Co. for the erection of an ice machine.

Haverhill.—E. H. Moulton will erect a cold storage house. Westinghouse, Church, Kerr & Co. are building the machine, which will be of size to cool 30,000 cubic feet to temperatures of 10° to 40°.

Springfield.—H. L. Handy & Co. are building a small cold storage house for the general trade. Westinghouse, Church, Kerr & Co. are building the machine.

Hyde Park.—Hyde Park is to have a factory for the manufacture of ice.

MICHIGAN.

Grand Rapids.—L. A. Austin will build a cold storage house on East Bridge street near North Lafayette, to cost $3,000.

Martin.—Shepherd Bros. are maturing plans for a cold storage house.

MISSISSIPPI.

Biloxi.—An ice factory, to cost $35,000, is now in course of erection.

Meridian.—B. Crisler, now operating a spoke factory, will organize his business into a stock company, when, it is said, an ice factory will be put in by the new company.

MISSOURI.

Mexico.—A St. Louis capitalist is organizing a company to build an ice factory.

St. Louis.—The Griesedieck Artificial Ice Co. have ordered from A. Ruemmeli-Hacker & Co. gradirworks for cooling the condensing water of the ice factory.

NEW YORK.

Far Rockaway Beach.—Murray & Rohe are putting in a new boiler in their Hygeia Ice Works.

Gravesend.—Wm. Texter is building an ice making and

cold storage plant at Ulmer Park, and has purchased his machine from the Remington Machine Co., Welmington, Del.

New York.—The Hotel Beresford has bought a 10-ton refrigerating machine from the Case Refrigerating Machine Co., of Buffalo.

Port Chester.—Several Port Chester citizens have formed a company, with a capital of $18,000, and propose the establishment of an ice manufacturing plant. The project was first broached last season, but the plentiful supply of ice caused its temporary abandonment. The mild weather of this winter has revived interest in the scheme, and it is expected that the plant will be ready to begin operations before the commencement of warm weather.

NEBRASKA.

Norfolk.—The erection of a cold storage plant for the Norfolk Produce Co. is being rapidly pushed. The storage capacity will be thirty cars. The building is being put up according to the Dexter patents.

NORTH CAROLINA.

Charlotte.—The Standard Ice and Fuel Co. has completed its buildings, and will put in the machinery as soon as received.

Charlotte.—A Columbia paper says that the Palmetto Ice Co., of Columbia, S. C., is rapidly making all arrangements to establish a branch of the factory here. The branch factory, which will be about the capacity of the one at Columbia, will be erected in the very near future. There will be no Charlotte capital in that factory, but it will be an enterprise started and maintained by the Columbia men who compose the Palmetto Ice Co.

OHIO.

Delaware.—Some railroad officials with Mr. Born, the Columbus brewer, were here recently hunting a location for a cold storage house.

Fostoria.—There is talk of putting up a storage house here.

Kinsman.—E. H. Bidwell, merchant, is putting up a cold storage house.

Newark.—The directors of the Newark Ice and Cold Storage Co. have decided to rebuild. The building was recently destroyed by fire at a heavy loss. There will be a slight change in the boiler room, it being of brick, 30×36 feet and twenty feet high, with iron self-supporting truss roof. Work is now progressing on the building.

Massillon.—K. F. Erhard has bought a 15-ton machine from the Sulzer-Vogt Machine Co., Louisville, which will be ready to make ice by April 1.

Bucyrus.—F. Deck, the brewer, contemplates putting in another ice machine to make ice for the retail trade.

OKLAHOMA.

Enid.—Henry Schwartz, of the Ferd. Heim Brewing Co., is trying to get local investors interested with them in the erection of a cold storage and ice factory.

Enid.—The Enid Ice and Cold Storage Co. is putting in an 18-ton Blymyer absorption ice machine, to be in operation by March 1. The plant will have an unlimited supply of pure water. There will also be four cold storage rooms, one of which will be used by the Anheuser-Busch Brewing Association for beer storage. On September 15, 1893, Enid was a bare prairie; now it has a population of 5,000, and expects to be the headquarters of a railway division.

PENNSYLVANIA.

Allegheny.—The Chrystal Ice Co. is putting in a 60-ton ice machine built by the Hercules Ice Machine Co., Aurora, Ill.

Beaver Falls.—Leonard Strub writes us that he has in contemplation the erection of an ice factory here.

Bryn Mawr.—The Bryn Mawr Ice Manufacturing and Cold Storage Co. has been organized by W. H. Ramsey, Jas. Florey and others. They have made a contract with the Pennsylvania Iron Works Co., Philadelphia, for a 30-ton ice making plant complete. The plant is to be very carefully erected, and, it is believed, will, when finished, be one of the finest ice making plants in the United States.

Hazleton.—The Mercantile Co., ice dealers, will put up an ice factory.

Philadelphia.—The Consolidated Ice Manufacturing Co. is to build a two-story brick and iron ice house, 56×70 feet, on the west side of American street, north of Dauphin. Foundations for two engine houses and steam boilers are also to be built.

Philadelphia.—The authorities in charge are about to fit up the morgue with a refrigerating machine.

Philadelphia.—The Consolidated Ice Manufacturing Co. are now enlarging that plant, with putting in Hercules machines, now building.

RHODE ISLAND.

Providence.—The cold storage building, now being erected by the Cold Storage Co., Harris and Kinsley avenues, will probably be finished not later than midsummer. It is a commodious, durable, handsome structure, and will require about 4,000,000 bricks. Its cost is estimated at at least $125,000. It will be four and five stories high, and is admirably equipped for the uses to which it is to be put. It was begun about November 1, and the work has been steadily pushed.

SOUTH CAROLINA.

Sumter.—The Sumter Ice Manufacturing Co. is now engaged for the second time within eighteen months in enlarging the capacity of their plant.

TENNESSEE.

Knoxville.—The Hotel Hattie, F. McNulty, proprietor, is being overhauled and modernized throughout, with the dining room on the upper floor. A portion of the first floor is fitted up for cold storage, not only for the uses of the house, but for a local custom business in addition. The refrigerating apparatus for cooling these rooms is furnished by Westinghouse, Church, Kerr & Co., and an independent electric lighting plant is being installed by the Westinghouse Electric Co. The remodeled hotel will open for business about March 1.

Nashville.—The Nashville ice factory, sold at public auction on December 13, 1893, by order of the stockholders, in order to go out of business, was bought by the bondholders of the company for about $30,000, thus realizing enough to pay all debts. The bondholders reorganized under the name of the Nashville Ice Co., with the following board of directors: W. A. Atchison, S. L. Demoville, Jno. R. Sneed, H. Metz, M. B. Toney, R. H. Gordon and Wm. Porter. W. A. Atchison, the president of the old company, was elected president; S. L. Demoville, vice-president, and R. H. Gordon, secretary. The capital stock has not yet been determined.

TEXAS.

Hempstead.—The Magnolia Brewing Co., of Houston, will erect a cold storage building and ice house in Hempstead.

San Marco.—The San Marco Ice Co. has put in a Hercules machine.

Sherman.—In connection with the remodeled works of the Sherman Ice Co., A. Ruemmeli-Hacker & Co., St. Louis, are erecting in this plant a water cooling apparatus (gradirwerks) similar to, though smaller, of course, than the gradirwork recently erected by the same people for cooling the condensing water for the 500-ton De La Vergne machine in the Anheuser-Busch Brewing Association's refrigerating plant at St. Louis. The western agency, at St. Louis, of the De La Vergne company, sold this ice factory the 30-ton machine which has been erected in the new factory.

Temple.—The Temple Ice Co. has remodeled that plant, putting in a new Hercules machine.

WEST VIRGINIA.

Wheeling.—P. F. McDonnell wants a good refrigerating machine at a low figure.

Wheeling.—Louis Niebergall's new ice plant at Forty-fifth and Water streets, will soon be ready for operation.

Wheeling.—The secretary of state has issued a certificate of incorporation to the Arctic Ice and Storage Co., with an authorized capital of $500,000. The incorporators are Henry Schmulbach, Peter Welty and Bernard Klieves, of Wheeling; Samuel S. Block and Aaron Block, of Pleasant Valley, Ohio county, W. Va.

WISCONSIN.

West Bend.—John Lohr is building a cold storage house.

RAILWAY REFRIGERATION NOTES.

——The Jacob Dold Packing Co., of Kansas City, is in the market for fifty refrigerator cars.

——The Cold Blast Refrigerator Co., of Kansas City, is asking for bids for about 200 refrigerator cars to be built on the Chase system.

——At the annual meeting of the stockholders of the Northern Pacific Refrigerator Co., held in Newark, N. J., January 10, the following were elected directors for the ensuing year: Louis A. Von Hoffmann, William Mertens, F. M. Thieriott, F. Overbeck and William Linn Allen.

——Winter caught white fish are commencing to come in from Lake Winnipeg and Lake Manitoba, Canada. These fish have acquired a good reputation in the United States, and the bulk of the catch crosses the line.

——The Trescott Sturgeon Packing Co. received several car loads of machinery, gear and supplies from Portland January 3, and have a large force of men at work getting their premises into order. The freezer is all but finished, and the freezing room, ice house and other offices are being pushed rapidly to completion. The company have established their headquarters in British Columbia at New Westminster, and intend to ship large quantities of sturgeon to the east.

——A Rockford (Ill.) special correspondent, January 18, is responsible for the following: "A sight seldom seen is attracting the attention of hundreds of people at Pecatonica. A small stream near the town during the cold weather was frozen to such a depth as to freeze the fish fast in the ice. Now that the ice has thawed some, thousands and thousands of fish can be seen protruding from the ice, bull heads, buffalo fish, pickerel and bass. Several fish that were near the bottom have been chopped out and found to be quite lively after being left a little while in cold water."

ICY ITEMS.

——Alfred Chaplin has gone into the ice business at Rowley, Mass.

——B. F. Lamb has sold his ice business to McCormick & Evans, Geneva, Neb.

——Lyman Balcon has purchased the ice business of Eli Carrington, Bath, N. Y.

——Wm. Park has resigned as manager of the Crystal Ice Co., Youngstown, Ohio.

——F. W. Doane has bought of Fred Britton his ice business at Northfield, Mass.

——Nathan G. Howard sold out his ice business at South Newmarket, N. H., to J. F. Chick.

——J. L. Quass has resigned his position as manager of the J. B. McNabb Ice Co., Salem, Ohio.

——Chandler & Chandler, of Lincoln, Neb., are now operating the cold storage house at Saginaw, Mich.

——The Crystal Ice Co., Davenport, Iowa, will increase capital stock by $10,000 to secure working capital.

——George E. Zartman and Fred Hulbert have formed a copartnership for the ice business at Waterloo, N. Y.

——R. H. Hanna has purchased the retail business of the Creston Waterworks Ice Co., Creston, Iowa, and has leased their ice house.

——The Portage Lake and Lake Superior Ice and Cold Storage Co., of Hancock, Mich., has been incorporated with capital of $10,000.

——W. E. Grinnell has purchased the ice plant of J. F. Bickmore, Searsport, Me., and commenced cutting ice for local use December 27.

——The Urbana (Ohio) Artificial Ice Co. has elected Henry Helps, president; John Mayse, secretary and manager; S. L. P. Stone, treasurer.

——Mr. S. B. Gage, of Benton, has purchased the ice business of John Conklin & Son at Penn Yan, N. Y., and will continue the business.

——The directors of the Youngstown (Ohio) Ice Co. have elected J. H. Fitch, president; J. A. Campbell, vice-president; L. W. King, secretary.

——The Hercules Ice Machine Co. have sold a 60-ton refrigerating plant to go into the skating rink of the National Ice Skating Co. of San Francisco.

——The Crystal Ice Co., of Dallas and Oak Cliff, Tex., has been incorporated; capital, $20,000; incorporators, Phillip Henry and D. and J. M. Lindsley.

——Harry W. Burrill, of West Medway, has purchased the S. W. Hayward ice business in Milford, Mass., where he has a capacity of storing 5,000 tons.

——The Adams Ice Co. has been licensed to incorporate at Chicago; capital stock, $5,000; incorporators, Joseph Seidel, Max Wortsman and Martin Lutiner.

——It is expected that the ice plant on Newark avenue, Bloomfield, N. J., will be started again, owing to the prospects of a deficiency in the supply of natural ice.

——Sam'l Weidman, Dan'l E. Brennan and Sam'l G. Roberts have formed a partnership at Shenandoah, Pa., to operate as the City Ice Co., of Shenandoah; capital, $9,000.

——P. G. Fogelstrom, L. P. Johnson and K. W. Sundstrom have organized an ice company at Brainard, Minn., and will at once commence putting up ice for use in that city.

——The Berwyn Ice and Coal Co. has been licensed to incorporate at Berwyn, Cook county, Ill.; capital stock, $5,000; incorporators, P. B. Weiss, H. S. Lock and Fred Thomas.

——A. A. Colley, ice dealer at Ottawa, Ill., has sold his plant to Clarence Glover and Louis Lynch, and accepted the position of captain of the guard at the Joliet penitentiary.

——Rowan Brothers have purchased the ice house of Bishop & Son, at Loveland, Cincinnati, Ohio, and are preparing to house ice on a large scale, should the season prove favorable.

——The Arctic Ice Co., Cincinnati, on January 9 elected the following officers: J. W. Wilshire, president and treasurer; J. W. Bullock, R. A. Holden, J. V. Gunthrie and Howard F. Winslow.

——The Wickes Refrigerator Co. has been incorporated at Cincinnati; capital, $5,000; incorporators, Howard Douglass, Julius Balke, B. A. Brunswick, Henry Gross and Calvin W. Starbuck.

——The Champion Ice Co., Cincinnati, elected its old board of directors January 8, and organized as follows: President, Brad. Shinkle; superintendent and treasurer, R. W. Dugan; secretary, J. Allen.

——The Canton (Ohio) Artificial Ice Co. on January 15 elected officers as follows: President, Robert A. Miller; vice-president, Charles W. Keplinger; secretary and treasurer, F. S. Hartzell.

——The American Ice Co., of Buffalo, was incorporated January 9, to buy, sell and harvest ice; capital, $30,000; directors: Charles McCarthy, Daniel Delehanty and Peter S. Carr, of Buffalo.

——The stockholders of the Crystal Ice Co., Dalton, Ga., at their last meeting decided to sell the plant, the reason for selling being that each is engaged in other business and could not devote time to it.

——The partnership between Philo T. Bates and Seymour B. Gorham, as the Ionia (Mich.) Ice and Fuel Co., has been dissolved, Mr. Bates continuing the fuel business, while the ice trade falls to Mr. Gorham.

——The stockholders of the Youngstown (Ohio) Ice Co. held their annual meeting January 8, and elected the following board of directors: John H. Fitch, J. A. Campbell, L. W. King, Thomas Connell and J. Howard Shields.

——The Lake Superior Ice Co., Marquette, Mich., January 9, elected the following officers: R. R. French, president; J. P. Werner, vice-president; C. H. Kelsey, secretary and treasurer. Mr. Kelsey was also appointed general manager.

——The Holyoke and South Hadley Falls Ice Co., Holyoke, Mass., have elected the following officers: President, R. M. Fairfield; agent and treasurer, Fred A. Smith; board of directors, William Nash, C. H. Heywood and R. M. Fairfield.

——The plant and the personal property of the Cottage Grove Ice Co., Cleveland, were sold by the receiver January 7 for about $9,000, to A. C. Hord, presumably acting for the stockholders. It is thought the company will be reorganized.

——The total consumption of manufactured ice in Denver for last year was about 36,000 tons, which represents in capital $144,000. Transactions of small dealers in lake ice will probably swell this amount to $150,000 as Denver's ice bill for 1893.

——The Arctic Ice Co., Newport, R. I., has elected the following officers: President, Lucius D. Davis; treasurer, John Howard; secretary, Gardiner B. Reynolds; superintendent, John H. Greene; clerks, Charles B. Marsh and James A. Greene.

——W. Porter has been elected general manager of the Crystal Ice Co., Youngstown, Ohio, to succeed William H. Park, resigned. Mr. Porter has had charge of the local branch of the Cleveland Provision Co. He will take charge about February 1.

——At a recent meeting of the directors of the Twin City Ice Co., Moline, Ill., Swan Tropp was elected manager. When the different ice companies consolidated, Swan Tropp was elected president, and for the past year he has not taken an active part in its affairs.

——The Carthage (Mo.) Ice and Cold Storage Co., has elected annual officers as follows: President, A. Hausman, of St. Louis; vice-president, M. L. Reid; secretary and treasurer, Dr. A. H. Caffee; attorney, H. H. Harding; superintendent, A. H. Snyder, Carthage.

——A meeting of the stockholders of the Palmetto Ice Co., of Columbia, S. C., has been called to be held on February 15, for the purpose of completing arrangements for the establishment of a new branch factory in Charlotte, N. C., and enlarging the present plant in Columbia.

——The annual meeting of the Arctic Ice Co., Cleveland, was held January 9, when the following directors and officers were elected: R. A. Holden, Jr., J. V. Guthrie, J. W. Bullock, A. Hickenlooper and J. W. Wilshire, directors; J. W. Wilshire, president and treasurer, and H. S. Winslow, secretary.

——On January 9 the Huse & Loomis Ice and Transportation Co., St. Louis, elected the following officers: Wm. L. Huse, Wm. Loomis, Chas. W. Whitelaw, H. E. Penning, George F. Foster, directors; Wm. L. Huse, president and treasurer; Chas. W. Whitelaw, vice-president; H. E. Penning, secretary.

——The Middlesex ice houses, on Lake Pentucket, Georgetown, Mass., were sold January 9, to the Fells Ice Co., of Wyoming, Mass. The price was $5,000; $1,000 down and the balance to be paid in ten days. The houses are more than half-filled with good quality ice, and the houses are situated on the B. & M. railroad.

——At the annual meeting of the stockholders of the Waco Ice and Refrigerating Co. in January, the following gentlemen were elected as directors: J. W. Mann, Alfred Abeel, T. C. Tibbs, J. K. Rose, L. C. Alexander. Officers, J. W. Mann, president; Alfred Abeel, vice-president; J. K. Rose, treasurer; Jas. E. Egan, secretary.

——The annual meeting of the Burlington (Vt.) Cold Storage Co. was held January 2, when the old officers were re-elected as follows: Directors, U. A. Woodbury, A. C. Spaulding, Henry Greene, R. G. Severson, J. B. Scully; president, U. A. Woodbury; vice-president, Henry Greene; secretary and treasurer, R. G. Severson.

——The Cumberland Ice Co., Cumberland, Md., has elected the following directors for the ensuing year: Messrs. Geo. Schwarzenbach, Lloyd Lowndes, David Walker, Thomas McCann, C. C. Hedges, A. D. Ladew, James Kirk, Chas. Dilger and F. A. Blaul, and the following officers: President, George Schwarzenbach; treasurer, Lloyd Lowndes; manager, David Walker.

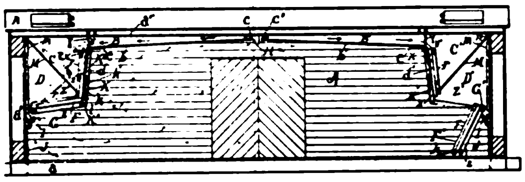
——A new cupola metal called "semi-steel" has recently been invented and is being manufactured. It is of a very fine texture, tough, strong, solid and perfectly free from blow holes, and is said to be especially suitable for ammonia, hydraulic and pneumatic cylinders. Its tensile strength compared with other metals is as follows: Common cast iron, 2, cast steel, 6, semi-steel, 3.3.

We append below the most important new patents relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for ICE AND REFRIGERATION.

DEVICE FOR REFRIGERATION AND STORAGE.

No. 509,805. Chas. S. Hardy, San Diego, Cal. Filed January 4, 1893. Serial No. 457,244. Patented November 28, 1893. (No model.)

Claim.—10. A refrigerating chamber having a longitudinal draft flue and having at one end of said flue a



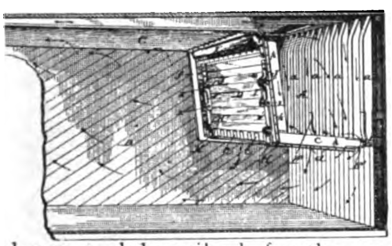
section jointed to and forming practically a hinged extension of the lower wall of said flue, all substantially as shown and described.

11. The combination of the refrigerating chamber, the side cleats and the hinged wall and floor of the ice box or receptacle, said wall and floor being arranged to open or turn outward against said side cleats and to be supported thereby when so adjusted, all substantially as and for the purposes set forth.

REFRIGERATOR CAR.

No. 509,806. Charles S. Hardy, San Diego, Cal. Filed May 15, 1893. Serial No. 474,251. Patented November 28, 1893. (No model.)

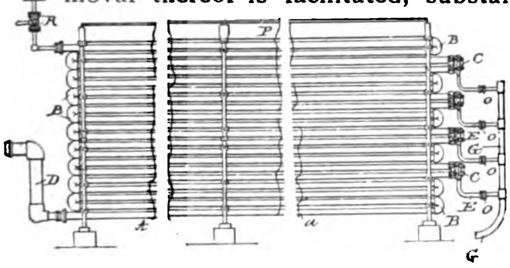
Claim.—1. In a refrigerator car, the combination, with the cleats attached to the vertical wall of a car, and the floor section having transverse cleats, of the two sets of *V*-hinges applied to the ends of the cleats and connected by a pintle which is located in line with the longitudinal center of the said cleats, as shown and described, for the purpose specified.



CONDENSER.

No. 507,039. Hermann Rassbach, Washington, D. C. Filed September 26, 1891. Serial No. 406,897. Patented October 17, 1893. (No model.)

Claim.—1. In a condenser for ammonia gas or similar fluids, a series of condensing pipes provided at suitable intervals with separable couplings having drainage pipes; the drainage pipes provided with a second joint out of line with the condensing pipes joined by the separable coupling, whereby the removal thereof is facilitated, substantially as described.

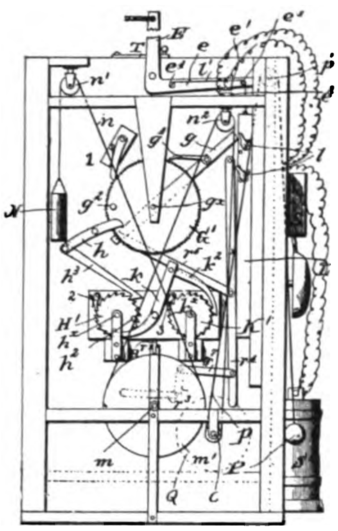


2. In a condenser for ammonia gas or similar fluids, a series of condensing pipes having at proper intervals separable couplings secured together by bolts and provided with drainage pipes communicating with a common manifold or header, substantially as described.

SIGNALING AND REGISTERING DEVICE FOR ICE MAKING PLANTS.

No. 508,737. Andrew J. McArthur, Gainesville, Fla. Filed August 16, 1892. Serial No. 443,253. Patented November 14, 1893. (No model.)

Claim.—1. In an ice making plant, the combination with the water supply tank, provided with a float, of a signal, a registering device and a time recorder, a lever connected with said float, connections between said lever and said signal for operating the signal on the upward movement of the float and connections between said lever and the registering device and time recorder for operating the same on the downward movement of the float, substantially as described.



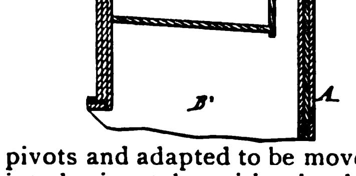
6. In an ice making plant in combination with a water supply tank and freezing cans, of a float adapted to rise and fall with the water of the tank, a discharge pipe for filling said cans, a register, a lever and pawl for operating said register, a slide provided with spring pawls or projections for engaging and moving said lever and pawl when moving in one direction only, and connections between said float and slide, substantially as described.

7. The combination with the tank and a float adapted to rise and fall with the water in the tank, of a register, the register operating lever and pawl, a time recorder having a record disk and a movable record pencil connections between the register operating lever and said pencil, a slide for actuating the said register operating lever when moving in one direction only and connections between said float and slide, substantially as described.

REFRIGERATOR.

No. 508,520. Henry Kroenke and Ernst Bindewald, New York, N. Y. Filed July 27, 1893. Serial No. 481,597. Patented November 14, 1893. (No model.)

Claim.—1. The combination, with the main storage chamber of a refrigerator, of an ice chamber, a lower storage chamber, a trough extending transversely across the upper part of the main storage chamber, a partition in the rear part of the main storage chamber, said partition forming a channel or duct between the main storage chamber and its trough and the rear wall of the refrigerator, guide ways extending from the trough to the front wall of the refrigerator, recessed corner pieces at the front ends of said guide ways, and a door provided with pivots and adapted to be moved from its closed position into horizontal position in the interior of the refrigerator and back again into closed position, substantially as set forth.

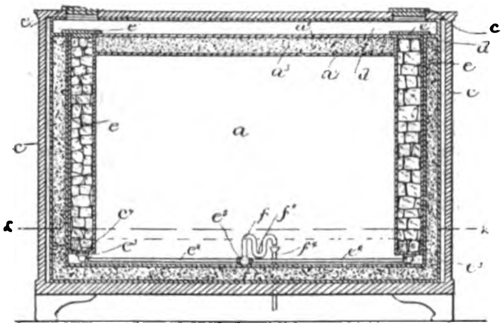


REFRIGERATOR.

No. 506,593. George G. Hackett, Wakefield, Mass. Filed January 3, 1893. Serial No. 457,051. Patented October 10, 1893. (No model.)

Claim.—1. A refrigerator, comprising in its construction a storage chamber, a vertically arranged receptacle therein adapted to receive ice, conduits communicating with said receptacle and extending along the bottom of the car under the floor of the storage chamber, and an outlet or overflow pipe connected with

said conduits, but located above the latter so that the



conduits cannot be emptied through said outlet, the said conduits being adapted to be kept constantly filled with refrigerating compound, whereby large areas of cooling or heat absorbing surface will be presented at the bottom of the car, as set forth.

BREWERY REFRIGERATION NOTES.

——The Lemp Brewing Co., of St. Louis, is building a storage warehouse in Quincy, Ill.

——The Schmulbach Brewing Co., Wheeling, W. Va., has recently completed a new ice house.

——The Dubuque Malting Co., Dubuque, Iowa, is building a cold storage house at Dyersville, Iowa.

——The Clinton Co-operative Brewing Co., Buffalo, has bought a 60-ton Case refrigerating machine.

——The Medlin Pilsener Brewing Co., Cleveland, Ohio, has contracted for a 25-ton "Case" refrigerating machine.

——The Magnolia Brewing Co., Houston, Tex., will build a cooler at Hempstead large enough to hold several cars of beer.

——The Eagle Brewing Co., of Hamilton, Ohio, has purchased a 35-ton refrigerating machine of the Vilter Mfg. Co., Milwaukee.

——Jacob Hornung, brewer, Philadelphia, has bought a 10-ton refrigerating machine from the Case Refrigerating Machine Co., Buffalo, N. Y.

——The Beadleston & Woerz Corporation, New York city, are building a $1,000 ice house (26×19 feet, one and one-half stories) in Brooklyn.

——The Schwarzenbach Brewing Co., Germania, Pa., has been fitted up with a 10-ton refrigerating plant, built by the Case Refrigerating Machine Co., Buffalo.

——The Mount Pleasant Brewing Co., Mount Pleasant, Pa., is putting in a 40-ton refrigerating machine, built by the Case Refrigerating Machine Co., Buffalo.

——Mr. Adam Gintz, president of the Western Brewery Co., Belleville, Ill., has contracted for an ice making machine, which will have a capacity of 150 tons a day.

——The De La Vergne Refrigerating Machine Co., New York, are remodeling the cellar of Geo. Gunther, at Canton, Mo., which will hereafter be cooled by machine.

——A. Ruemmeli-Hacker & Co., St. Louis, will erect three additional gradirworks for cooling the ammonia condensing water of the entire refrigerating plant of the Anheuser-Busch Brewing Assn.

——The Wm. J. Lemp Brewing Co., St. Louis, have made a contract with A. Ruemmeli-Hacker & Co. for the erection of gradirwork for cooling the ammonia condensing water of the brewery refrigerating plant.

——The Anheuser-Busch Brewing Association has purchased land at Battle Creek, Mich., on which will be built a three-story cooler, 40×100 feet in size, making that city a beer-distributing point for Michigan.

——At a meeting of the Augusta Ice Co., Augusta, Ga., held January 8, the following officers were elected: President, H. Hahn; vice-president, F. Gherkin; directors, P. G. Barum; C. H. Oetjen, D. Gherken, George R. Lombard, John Sancken; Mr. Sancken, manager. The company is in a prosperous condition and will soon make improvement to double the capacity of the works.

——The Vilter Manufacturing Co., Milwaukee, Wis., announce that matters pertaining to the assignment of the company have been settled satisfactorily to all concerned, and the assignee, Mr. Herman Segnitz, on December 26, received his discharge by the court. The business being again in the company's name, and all matters in their charge, they ask for a continuance of the patronage of the public.

——At the annual meeting of the Wheeling Ice and Storage Co., January 16, the following list of directors were elected: J. A. Miller, C. P. Brown, Dr. L. D. Wilson, Julius Pollock, R. K. Friend, Christian Schnepf, C. W. Conner. The plant has been started up to fill up their storage rooms with ice for the coming season. The prospects seemed to be that the company will have several large houses to fill for individuals who are becoming piscouraged at the prospects for a stock of river ice this winter.

ICE AND REFRIGERATION ILLUSTRATED

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

VOL. VI. NO. 3. CHICAGO : NEW YORK : MARCH : 1894. $2.00 PER ANNUM

[*Written for* ICE AND REFRIGERATION.]

MEASURING EFFICIENCY.

RELATIVE EFFICIENCY OF THE CARNOT CYCLE—RESULTS OF WET AND OF DRY COMPRESSION COMPARED—THE DIFFERENCES IN EFFICIENCY SMALL.

By GEORGE RICHMOND, M. E.

It has been already pointed out that all the thermodynamic problems of interest in connection with the ice machine can be solved by means of graphic construction. If the curves A and B are drawn to a tolerably large scale the results so obtained will be as accurate as the data warrant. It is possible therefore to discuss fully and completely all such problems on the drawing board, and without the aid of any mathematics whatever. The checking of the results by finding the values of the various lines and areas in the tables from which they have been derived is simply a question of elementary mensuration.

To those readers who are accustomed to the analytical method the graphic method may seem wanting in conciseness and elegance. While these articles are written chiefly for the benefit of those to whom the analytic method is unavailable, it may be easily seen that the quantities occurring in the usual formulas are represented in the heat diagram, and can readily be written down at sight, an obvious advantage, since we cannot be said truly to possess a subject when the memory has to be trusted or the text book consulted. This fact will be illustrated from time to time, and paragraphs relating to this branch of the subject may be omitted by those who desire to rely entirely on the graphical method without any loss of completeness.

For example, the adiabatics in the heat diagrams are all verticals. A straight line is determined analytically when two points in it are found. Consider any adiabatic cutting off say x_1 per cent from AB_1 and x_2 per cent from AB_2 representing, of course, the compression of a gas originally containing x_2 per cent of gas and finally, after compression, x_1 per cent. Starting from the zero point of entropy on the A curve, we travel along it till A_2 is reached, and then we travel along AB_2 till the adiabatic is reached. The horizontal distance traveled is:

$$A_2 + x_2\,AB_2$$

Starting at the same point, we travel along the A curve till A_1 is reached, and then travel along AB_1 till the same adiabatic is reached. The horizontal distance traveled is:

$$A_1 + x_1\,AB_1$$

What is termed the equation to the adiabatic is evidently the statement that these two distances are equal, or—

$$A_2 + x_2 AB_2 = A_1 + x_1 AB_1 \quad\ldots\ldots\ldots\ldots(1)$$

or in the usual notation.

$$c\log.\ T_2 + x_2\frac{L_2}{T_2} = c\log._e\ T_1 + x_1\frac{L_1}{T_1} \quad\ldots\ldots\ldots\ldots(2)$$

This is a simple illustration of an important principle, by the aid of which many relations reached by considerable analytical work may be written down at sight. It is sometimes stated in words somewhat as follows: *The entropy imparted to a body to cause it to pass from one adiabatic to another is the same by whatever path it is carried.*

The numerical examples given ~~last month~~ January may, of course, be solved from equation (1) or (2).*

The proper proportion of gas and liquid for wet compression may be brought into the cylinder in one of two ways: The expansion cock may be so regulated that the ammonia in its passage through the coil is not fully vaporized, or the requisite amount of liquid may be added to the gas at the compressor itself. The former is the method in general use, although it would seem that the latter method proposed by the writer in 1882 possesses

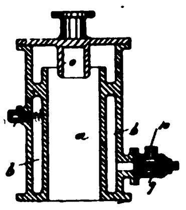


FIG. 1.

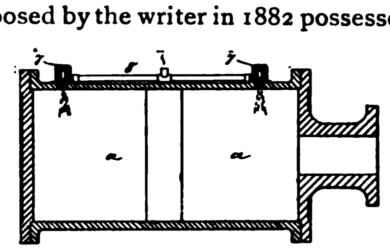


FIG. 2.

certain advantages, especially when direct expansion is used, and the expansion cocks are at a distance from the engine room. In practice, even with the expansion coils close at hand, the regulation is rarely conducted so as to obtain the highest efficiency. By injecting into

*Example 5 of last month requires correction, as follows:

$$\frac{n-m}{n} = \frac{AB_2 - AB_1}{AB_2} = \frac{\alpha}{x\,AB_2}$$

Therefore $x = \dfrac{\alpha}{AB_2 - AB_1} = 59.4.$

the compressor itself the regulation is more direct and easy, and therefore more likely to be attended to. Figs. 1 and 2 are taken from the patent drawing No. 268,347, Wood & Richmond, Fig. 2 showing injection into the cylinder and Fig. 1 injection into the jacket.

When liquid is added in order to cool the cylinder, during compression, it is more convenient to put the question as to amount in the form, what per cent of liquid must be added to a change of dry gas to secure dry saturated gas at the end of the stroke, or gas of any desired degree of superheating? If a mixture contains x per cent gas and $1-x$ liquid, which is the meaning hitherto assigned to the symbol x, then evidently the per cent of liquid to be added to the gas is

$$\frac{1-x}{x} = y, \text{ say.}$$

In the diagram

$$y = \frac{\beta}{AB_2 - \beta} \qquad (3)$$

and in equations (1) and (2) we may write $\frac{1}{1+y}$ for x.

EXAMPLE.—The condenser temperature being 80°, and that of the refrigerator 10°, what per cent of liquid must be added to each cylinder full of gas?

From the diagram or from the table we find the values:

$$AB_{10} = 1.1688 \text{ and } \beta = B_{80} - B_{10} = .0947$$

$$y = \frac{947}{10741} = .088 = 8.8 \text{ per cent.}$$

If we have ascertained from the capacity of the cylinder, and the speed at which the compressor is run the quantity of dry gas which enters the cylinder in a given time, then to this amount we must add 8.8 per cent of liquid if the compression is by the cold or wet system. This quantity of liquid, whether it passes through the refrigerator or not, takes no part in the refrigeration proper; it has, in fact, to be cooled by the refrigerator from 80° to 10°. By the introduction of this liquid into the cylinder, what is the effect on the amount of work done?

If the gas had not been cooled by the injected liquid its final volume would have been increased by superheating, on the other hand, for this increase of volume by superheating we have substituted an increase of volume by evaporation so that at the end of the compression the volume is increased to 8.8 per cent. In addition to this we have to cool the introduced liquid by means of the refrigerator. The question as to whether or not upon the whole it is more

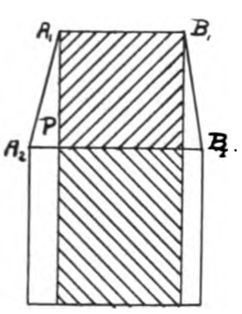


FIG. 3

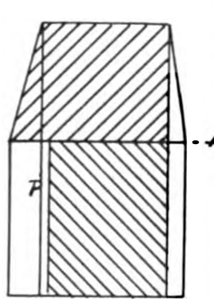


FIG. 4.

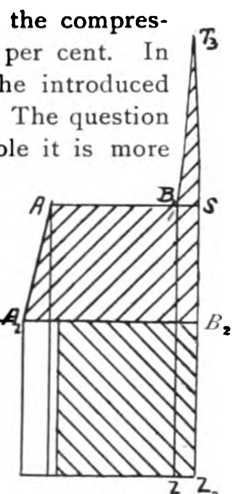


FIG. 5.

economical to introduce liquid is best answered—not by following up the inquiry on these lines, but by comparing the efficiencies of the different cycles.

By the efficiency of a refrigeration cycle is meant the ratio between the refrigeration and the work expended in obtaining it. The fact that these quantities can form a ratio implies that the work expended can be expressed in heat units, or *vice versa*. If we determine the work in a given cycle from the work diagram, we must divide the resulting foot pounds by 778 to convert them to heat units. In the heat diagram both the work and the refrigeration are expressed in heat units, and the ratio we are seeking is obtained so soon as we identify the areas representing the work and the effective refrigeration. For the purposes of comparison we take one pound of ammonia and suppose it compressed and transferred from the refrigerator, which is at 10° F., to the condenser, having a temperature of 80° F. The three cycles are shown in Figs. 3, 4 and 5, the shaded area above the isothermal T_2 being the work done and the shaded area below the same line is the consequent refrigeration.

In the Carnot cycle these are both rectangles and are therefore proportional to their bases, namely, T_2 and $T_1 - T_2 = \Theta$.

The efficiency of the Carnot cycle is therefore

$$e = \frac{T_2}{\Theta} = \frac{470}{70} = 6.71.$$

the actual refrigeration in heat units for one pound of ammonia is $T_2\,AB_1$ and the actual work $\Theta\,AB_1$ or in foot pounds $J\,\Theta\,AB_1$ where $J = 778$.

In the "cold" or "wet" compression the work is increased by the triangle P, and the refrigeration is reduced by the equal rectangular area.

The exact value—

$$P = c\Theta - T_2\,\alpha \qquad (4)$$

may be used, or the approximate value when the curve A is supposed to be straight, viz.:

$$P = \tfrac{1}{2}\,\alpha\,\Theta \qquad (5)$$

If $c = 1$ $P = (80-10) - 470 \times .1388 = 4.76.$
$R = T_2\,A\,B_1 = 470 \times .9353 = 439.59.$
$w = \Theta\,A\,B_1 = (80-10) \times .9351 = 65.47.$
If e_1 be the efficiency of the wet compression—

$$e_1 = \frac{T_2\,AB_1 - P}{\Theta\,A\,B_1 + P} = \frac{439.59 - 4.76}{65.47 + 4.76} = 6.191.$$

The refrigeration and work areas of the dry compression cycle may be easily determined from the figure when we know the temperature to which the gas is super-heated by compression. This temperature may be found graphically by passing the curve:

$$x = c_p \log._e y$$

or

$$\varphi = c_p \log._e T$$

through the point B_1 until it cuts the adiabatic through B_2 in the point T_3. This curve, as already explained, can be cut out in wood or metal once for all.

T_3 can also be found by applying the principle mentioned at an earlier part of this article. At the commencement of the compression we are at the point B_2 on the curve B, and the adiabatic $B_2\,Z_2$. The point B_1 on the adiabatic $B_1\,Z_1$ may be reached in an infinite number of ways, of which three are indicated on the diagram. The adiabatic $B_1\,Z_1$ may be reached by removing enough heat from the ammonia to liquefy a portion of it, namely, $\beta \div A\,B_2$ per cent; in this case we travel along the isothermal BA_2 a distance equal to β. Or, we might compress the gas and at the same time remove so much heat as to keep it constantly saturated. In this case we follow the curve B until the point B_1 is reached. Finally we may compress the gas along the adiabatic B_2Z_2 till the condenser pressure is reached, after which the gas is cooled at this constant pressure till it becomes saturated

at the condenser temperature. This is precisely the case of dry compression; the gas is compressed from B_2 to T_3, then cooled along the curve from T_3 to B_1. From B_2 to T_3 the horizontal travel is zero, and from T_3 to B_1 it is, as we have seen, β. But when a gas is cooled at constant pressure, the horizontal travel is proportional to its specific heat, and to the log. of the temperature; hence—

$$c_p \log. \frac{T_3}{T_1} = \beta \quad \ldots\ldots (6)$$

In this equation everything is known except T_3

$$c_p = .50836.$$
$$\beta = B_1 - B_2 = .0947.$$
$$T_1 = 460 + 80 = 540,$$

whence—

$$T_3 = 650 \text{ and } t_3 = 190^\circ \text{ F.}$$

Although this formula is very easy of application, we may still further simplify it by considering the curve through B_1 and T_3 a straight line. The surface between $B_1 Z_1$ and $B_2 Z_2$ is then a trapezoid whose area is—

$$\tfrac{1}{2}\beta\,(T_1 + T_3).$$

but this area also represents the heat necessary to superheat a gas from T_1 to T_3, from which point of view its area is—

$$c_p\,(T_3 - T_1).$$

Equating these two values, we have—

$$\frac{T_3 - T_1}{T_3 + T_1} = \frac{\beta}{2\,C_p}$$

Whence—

$$T_3 - T_1 = t_3 - t_1 = \frac{2\,\beta\,T_1}{1.017 - \beta} \quad \ldots\ldots (7)$$

This gives the rise in temperature above the compressor temperature. Instead of appealing to the figure the same result would have been obtained by substituting for $\log._e \frac{T_3}{T_1}$ the first approximation by expanding it in a series. The precise meaning of such an operation is, however, more apparent by the graphical method.

The formula obtained is so convenient that it is worth while to examine the nearness of the approximation. In the example above considered—

$$t_3 - t_1 = \frac{.1894 \times 540}{1.017 - .0947} = 111 \text{ nearly,}$$

the actual value as found by (6) for $t_3 - t_1$ being 190—80 = 110. The error is less than 1° F., more than sufficiently near for all practical purposes. The error will increase with the range of temperature, but for all practical purposes equation (4) may be relied upon.

There is still another method of finding the final temperature of compresion which is often convenient as it is based on the initial and final pressures.

It may be shown that—

$$\left(\frac{P_3}{P_2}\right)^a \text{ or } \left(\frac{P_1}{P_2}\right)^a = \frac{T_3}{T_2} \quad \ldots\ldots (8)$$

where a is a constant which can be determined, since all the other quantities are now known. The value of a thus determined is about .235. It may be determined in other ways, and care should be taken, in borrowing results from different sources, that the constants are determined with reference to the same fundamental data in each case.

Returning to the question of efficiency, the effective refrigeration in the case of dry compression is evidently—

$$L_2 - c\theta = 549.35 - 70 = 479.35.$$

The work done is

$$c\theta + L_1 + C_p(T_3 - T_1) - L_2 = 70 \times 504.66 + .508 \times 110 - 549.36.$$
$$= 81.22$$
$$e_2 = \frac{479.35}{81.22} = 5.902.$$

This assumes that no cooling is done during compression. Theoretically, at least, the temperature should not rise above that of the condenser, namely, T_1. The compression would then take place along the adiabatic $B_2 Z_2$ as far as S, whence it would follow an isothermal cutting off the triangle of work $S\ T_3\ B_1$. The area of this is—

$$c_p(T_3 - T_1) - T_1\,\beta = 55.92 - 51.14 = 4.78.$$

The efficiency would now be—

$$e_2 = \frac{479.35}{76.44} = 6.271.$$

Collecting these results,

Carnot cycle	6.71
Wet (or cold) compression	6.191
Dry (without cooling)	5.902
Dry (complete cooling)	6.271

Since one horse power represents .215 tons of refrigeration the maximum production in each of the above cases is 1.44 : 1.33 : 127 : 135 tons respectively.

It is seen that the difference in efficiency between the wet and dry compression is quite small, and that the possible saving by cooling the gas during compression is not large, of which possible saving only a small portion has been realized in practice.

[*Special report for* ICE AND REFRIGERATION.]

THE SOUTHERN ICE EXCHANGE.

PROCEEDINGS OF THE FIFTH ANNUAL CONVENTION—LIST OF DELEGATES PRESENT—PRESIDENT'S ADDRESS—ADJOURNED TO MEET AT ATLANTA AT A FUTURE DATE.

PURSUANT to call as published in the February issue of ICE AND REFRIGERATION, the fifth annual meeting of the Southern Ice Exchange was held in the rooms of the Chamber of Commerce in the Minnis building, at Knoxville, Tenn., February 13.

The meeting was called to order by the president, C. W. Biese, at 10:30 A. M. Among those present were the following: Edward E. Eagan, Asheville Ice and Coal Co., Asheville, N. C.; C. F. Sugg, Huntsville Ice Co., Huntsville, Ala.; J. R. Keller, Stratton Ice Co., Pensacola, Fla.; Morris Benjamin, Atlanta Ice Factory and Atlanta City Brewing Co., Atlanta, Ga.; Sol. Benjamin, Standard Ice Co., Atlanta, Ga.; Chas. W. Biese, Lookout Ice and Cold Storage Co., Chattanooga, Tenn.; Peter Kern, W. W. Woodruff and Ignaz Fanz, Knoxville Ice Co., Knoxville, Tenn.; H. W. Lynn, Crystal Ice Co., Knoxville, Tenn.; A. B. Bowman, Graham Ice Co., Johnson City, Tenn.; F. A. Frercks, Salisbury Ice Co., Salisbury, N. C.; A. W. Schwane, New South Brewing and Ice Co., Middlesborough, Ky.; W. C. Mack, Chicago; Emmor H. Lee, New York city, and J. F. Nickerson, ICE AND REFRIGERATION, Chicago.

A number of letters were received from members stating their inability to be present at this meeting. After the roll call had been completed, President Chas. W. Biese read his annual address, as follows:

Gentlemen of the Southern Ice Exchange:—Contrary to my desires and, I fear, to the best interests of the Southern Ice Exchange, you elected me a year ago as your presiding officer for a second term. The year previous had seen much to prevent the

making of money by the southern ice makers, and the year just passed has added its equally destructive hand to the work of its immediate predecessor. The past two seasons have perhaps been the worst in many respects that we will ever experience. There comes in every man's experience golden opportunities. If properly grasped, tenaciously held, industriously used and intelligently cultivated, they result in success. They teach their lesson. It is equally true that every industry must experience seasons of depression and months, even years, of hard labor without any but small returns. This teaches its lesson. We have had our term, and it has been a long one, of depression; and I believe that, if its lessons are properly heeded, and if its teachings propperly influence our actions, we will find just ahead of us an opportunity most promising. There are many reasons why this should be true. Adversity has taught us how to be economical, and the necessity of being so; to be careful in our credits; to be considerate of our competitors and progessive in our methods. This time of depression must end, and with its departure we will find occasion to use its lessons. Let us heed them and find our lost opportunities.

On the question of competitors and competition allow me to say a few words: Complaints have been heard during the past year, and, while I have not had them brought to my attention as an officer of the Exchange, still I know that certain differences do exist between members of this Exchange. I trust these differences may be amicably adjusted during this meeting. I have seen in my experience as an ice manufacturer several illustrations of the old story of the fight between the big dogs and the profitable result to the little terrier. We are lacking along this line. The sooner that we each realize the fighting abilities and proclivities of our competitor and agree with him for a peaceable sharing of the bone the better it will be for the big dogs. The terrier can care for himself. The idea that grown men, good business men, men of experience, will invest thousands of dollars in an enterprise and then run it for the profit of an unappreciative public simply to "down" another concern similarily circumstanced is against all reason; and yet, this is just what many of us have done and are doing,—cutting our own throats while the public gloats over the sensation and pockets the profits that properly belong to the manufacturer. Let us recognize each other as men, come together, discuss the questions of difference and settle the matter peaceably, to our profit and no one's hurt.

During the past two years ice has sold at very low prices in the whole South. This is right, and yet wrong. The public should have ice at reasonable prices. It is one of the necessities. But we should not make the prices so low as to leave us no margin of profit. I do not believe that this is a question upon which we, as an organization, should act, but it is a subject of such importance as to merit our discussion to the end that some plan may be suggested for individual action. For this reason I speak of it.

As each year calls us together as ice makers I feel a greater appreciation of our organization. I believe it has been of great value to every member who has taken an interest in its work and progress. I trust it may grow in power and influence until it becomes a great working force for good and counts every southern ice maker as a member.

Thanking you for your consideration and co-operation during the past two years, I offer you my farewell as your president with the heartiest good will to all, and best wishes for your individual prosperity and increased success as an organization.

On motion, the president's address was ordered spread upon the records of the Exchange. The minutes of the previous meeting were then read and approved.

The treasurer's report being read, on motion the president appointed the following committee to examine same and report at afternoon session: Morris Benjamin, E. E. Eagan and Peter Kern. On motion, a committee of three was appointed by the president to suggest matters for discussion and action to be taken by the convention, such committee to report at afternoon session. The following gentlemen were appointed: Sol. Benjamin, Atlanta; H. W. Lynn, Knoxville, and Edward E. Eagan, Asheville, N. C.

The regular order of business was then dispensed with, and a general discussion on subjects of interest to the trade was participated in by nearly all the members present. Differences between several members of the Exchange were discussed in a friendly spirit and explanations made. Mr. W. W. Woodruff, of Knoxville, suggested that a resolution be passed, stating it to be the sense of this convention that members of the Exchange should not ship ice into a city or town where a member of the Exchange was already located without first advising with such member. After some discussion action on the matter was deferred until afternoon session.

At two o'clock in the afternoon the delegates re-assembled at the Chamber of Commerce, where carriages were taken for a drive about the city in charge of the local members, when an inspection was made of the plants of the Crystal Ice Co. and the Knoxville Ice Co.

On returning to the hall from the carriage drive, some time was spent in informal talks; and it was not until 5:30 that President Biese called the meeting to order. The committees not then being ready to report, adjournment was taken to 7:30 P. M.

At 7:45 P. M. President Biese called the meeting to order. Mr. Morris Benjamin, chairman of the committee appointed to examine the treasurer's statement, reported that they found the books correct; and, on motion, the report was adopted.

Mr. Sol. Benjamin, of the committee of three appointed at the morning session, reported that the committee thought it to be to the best interest of the Exchange that on account of the small attendance no decisive action be taken at this time looking to the adoption of any rule or regulations to govern the members of the Exchange; and the committee suggested that an adjournment be taken to meet at a central location at a later date, and that in the meantime an earnest effort be made to induce a larger number of the ice manufacturers throughout the South to attend such meeting and then discuss and take action on important matters relating to the trade. After some discussion the report was accepted.

At the suggestion of President Biese, the regular order of business was then dispensed with, and some time was very profitably devoted to a general discussion of subjects of interest to the trade, such as the question of the best kind of ammonia to use, the matter of fuel and handling of boilers and water supply.

The following resolutions were then offered:

Resolved, That a vote of thanks be extended to the ice manufacturers of Knoxville for their courteous treatment of the members of the Exchange, and for the delightful drive through their beautiful city, the recollection of which we will always cherish as one of the most pleasant incidents of this meeting;

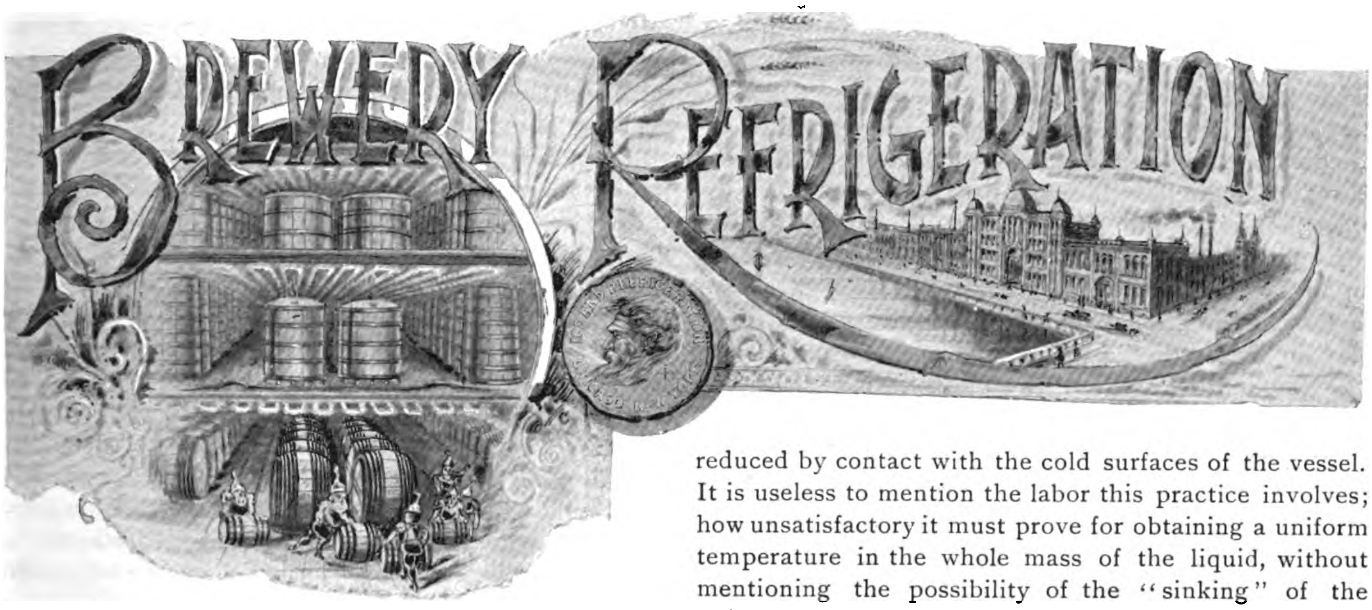
Resolved, That a vote of thanks be tendered to the Chamber of Commerce of the city of Knoxville for their kindness in placing their rooms at the disposal of the Exchange for our use during this meeting.

On motion the convention then adjourned to meet April 11 and 12, at the Kimbal house, Atlanta, Ga.

It was understood that each member present would use his personal influence to induce a large attendance at the adjourned meeting.

——Frank Fetter has purchased an interest in the ice business with John Stark, and the firm will be known as Stark & Fetter, Marion, Ohio.

——The ice firm of Dayton & Watson Bros., Birmingham, Conn., has been dissolved, Mr. Dayton retiring. The new firm will be Watson Bros. (Geo. G. and Wm. W.).



reduced by contact with the cold surfaces of the vessel. It is useless to mention the labor this practice involves; how unsatisfactory it must prove for obtaining a uniform temperature in the whole mass of the liquid, without mentioning the possibility of the "sinking" of the swimmer.

[*Written for* ICE AND REFRIGERATION.]

ARTIFICIAL REFRIGERATION IN BREWERIES.

THE COOLING OF THE WORT—DEVICES OF THE PAST FOR USING NATURAL ICE—THE LABOR INVOLVED AND UNSATISFACTORY RESULTS OBTAINED.

By AUGUSTE J. ROSSI, B. S., C. E.

(*Continued from February issue, page 100.*)

IN order to cool the hot wort many devices have been contrived. It is not in our province to describe them. (1) The Baudelot system has generally prevailed. With natural ice the brewer makes cold water in a tank adapted to such use by filling it with large pieces of ice taken from the ice house. This ice-cold water is caused to circulate by means of appropriate pumps from the bottom to the top and inside of a system of coils, generally of copper, over the outside surface of which the warm wort trickles down, the temperature of the wort being thereby gradually lowered. In order to economize the ice it has been the practice in many breweries to make this coil in two distinct and separate parts. Through the upper part water circulates as cold as can be obtained from wells or springs, by which action the temperature of the wort is brought down to 60° F. or thereabout; and through the lower part is circulated the ice-cold water, which further brings down the temperature of the wort to 40° F. Fresh ice has, of course, to be added to the ice water tank as fast as the ice melts in order to maintain the temperature of the liquid at a proper degree as it returns warmed up by its passage through the coils; and unless inadmissible quantities of ice be used it is evident that some of the water must be allowed to waste, otherwise it would reach a temperature excluding its use for this specific purpose. The handling of this ice is obviously an important factor of cost.

(2) We have now the sweet wort cooled down to 40° F. It is run into the fermenting tuns. To cool the beer in fermentation two methods have been used more particularly. In the first one "swimmers," a sort of conical vessels made of copper or tin, have been used. Whenever the temperature of the beer in a fermenting tun rises too high, so that the fermentation proceeds too fast, a "swimmer" is put in the tub, and in this swimmer, so constructed as to float on the surface of the liquid, pieces of ice are placed. The temperature of the beer is thus reduced by contact with the cold surfaces of the vessel. It is useless to mention the labor this practice involves; how unsatisfactory it must prove for obtaining a uniform temperature in the whole mass of the liquid, without mentioning the possibility of the "sinking" of the swimmer.

For these reasons, in many breweries attemperators (as the system has been called) have taken the place of the swimmers. They consist of a system of large horizontal coils placed in the tubs and immersed in the liquid in fermentation. In these coils the ice cold water obtained from the ice tank is caused to circulate by means of proper pumps. The coils are so arranged that they are independent for each fermenting tun, the opening and closing of valves directing the flow of cold water to one fermenting tun or the other, as the case may be. The ice water in its passage through the coils becomes warmed up, and is returned to the tank to be cooled again; but it is obvious that as fast as the ice melts to furnish the ice water the quantity of liquid must necessarily be increasing in the tank, and, unless it can be used for other purposes, which is not always the case, the surplus has to be wasted, which means the wasting of a proportionate quantity of ice.

In all these operations the rooms or cellars in which the fermenting tuns are placed are not cooled by the arrangements adopted; or if they are at all they are cooled at the expense of the fermenting tuns themselves, another cause of irregularity in the fermentation, unless some other means be adopted.

(3) In order to cool the fermenting rooms and the storage rooms or cellars, in certain breweries means have been adopted to cool the air by its passage over the surface of ice in the ice house and then discharge it in the fermenting rooms or cellars, or the cold water obtained from the melting of ice has been caused to circulate in piping properly hung to the ceiling; but this latter arrangement has been rarely resorted to with natural ice for obvious reasons of cost and waste, and the brewer has been satisfied to pile ice around the tanks, and to lay on the floor of the rooms or cellars, at certain intervals, large pieces of ice—a very expensive practice, necessitating the constant handling of cumbrous masses of ice, excluding neatness and maintaining the rooms and cellars in a constant state of dampness very injurious to the vats and casks, with results very often insufficient.

If cold is an agent of absolute necessity in breweries, experience has taught that this cold should be dry in order to secure satisfactory results. It is obvious that such a desideratum is incompatible with the use of natural ice in its solid form. The passage of air over large

masses of ice in order to cool it furnishes air more or less moist, and is almost as objectionable as the direct use of ice on this score. We will not mention here the methods which may have been resorted to to cool rooms by a utilization of the ice houses themselves. These methods have been applied for other purposes than those of breweries and as such do not properly belong here, and as especially in view of the substitution of artificial for natural refrigeration, they have lost, as far as breweries are concerned, at least, a great deal of their interest. Furthermore, even by such means the temperatures realized may prove in many circumstances not to be sufficiently low.

We may, however, mention that before the application of artificial refrigeration to breweries, some brewers had thought to overcome this difficulty by using a mixture of ice and salt. By mixing proper proportions of chopped ice and salt a liquid can be obtained, the temperature of which is several degrees below the freezing point. That such a liquid could be made available for purposes of refrigeration in breweries with much greater advantages than ice alone, cannot be denied. Circulated in pipes in a cellar or room or in the Baudelots, it would maintain the temperature of cellars, rooms and beer at safe figures or effectually and rapidly cool the hot wort. But there are some serious objections against its use. First, the salt has to be wasted, as the saline solution cannot be used whenever it has reached too high a temperature, and the cost of its evaporation in order to recover the salt could not be carried profitably, without mentioning the annoyance attending such practice, the mass of liquid to deal with being considerable. Furthermore, this system also implies the use of ice, consequently its use involves many disadvantages or drawbacks, which include the cost of having the ice harvested, transported and stored in special ice houses, and of ultimately rehandling it in the brewery, as well as the trouble of obtaining it in certain localities or in certain seasons and its absolute absence in others. Besides, in order to be most effective the mixture of salt and ice must be made with ice chopped fine, a condition adding to the cost of ice itself another item of expense.

In short, the brewer has undoubtedly realized very material and important advantages from the use of natural ice, notwithstanding the inconvenience, labor and cost attending such practice. He has been able to brew in all seasons and to have a better product, though his industry was still limited to certain climates or localities. But with cold under this form three elements of success were still lacking or deficient: easy adaptability, control and intensity. It was reserved for artificial refrigeration to solve the problem as completely as possible. By its application not only has the brewer been able to carry on his trade at all seasons, in every climate, in the temperate as well as the torrid zone, but he has obtained still further a cold controllable at will as intense as might be desired, and which can be utilized in a manner at once clean, successful, economical and automatic, so to speak, where and when it was required.

USE OF MANUFACTURED ICE.

The first mode of applying artificial refrigeration to breweries which was most likely to suggest itself was to replace the natural product by one which could be manufactured as fast as required and when required, independently of climate or of season, and to furnish ice-cold water, thus dispensing with the storage of natural ice—costly in certain years and in all cases occupying a room which could be used to better advantage for other purposes of the brewery.

If by such practice the intensity of the cold obtained was not controllable below a certain limit of temperature, at least a great progress had been made. Ice water at 32° F. could thus be obtained without waste; the brewer no longer had to pile up ice in the storage or fermenting rooms nor use the swimmers, since he could maintain, by the action of the machine, a fresh water liquid at a temperature absolutely constant if he so desired and very near to or at the freezing point, and circulate this cold liquid at his pleasure by the simple action of pumps, or even use it as had been done in some cases in the first attempts to apply artificial cold to cool the air of cellars.

The "artificial" ice used in this manner was, so to speak, an incidental product in the mass of water made cold by the machine, representing merely the surplus cold of the latter. The ice cold water, warmed by its passage through the Baudelots, the coils, the swimmers, or other devices, and having produced its useful effect in the brewery, being returned to the original refrigerating tank in which the action of the refrigerating machine was felt, could be continuously reduced to the freezing point (without any wasting of the cold by overflowing of said tank), both by this cooling action of the apparatus and by its contact with whatever ice might have been formed in the tank. The obtaining of a temperature reasonably low, and sufficiently low in many cases, was thus secured, and the objectionable dampness in cellars resulting from the use of ice in its solid state was removed to a great extent; the moisture of the air was condensed if not frozen on the cold surface of the pipes, when such devices were resorted to to cool the cellars, or the air was made cold by the machine and discharged in the cellars, having previously deposited its moisture on the contrivances used to cool it.

The economy realized therefrom was two-fold: First, the saving of the cold wasted by the melting of the natural ice when chunks of ice were piled in the rooms was an important item, without mentioning such other advantages as cleanliness, easy adaptation of the new system to any specific purposes, and dispensing with handling of ice; but also for technical reasons the refrigerating machine, working in these conditions of temperature, was precisely in the best condition of duty; that is, of cold produced for the mechanical energy expended.

It is a fact attested by brewers in all parts of the world that a machine capable of producing one ton of solid ice per twenty-four hours will produce in a brewery the amount of cold equivalent to the melting of one and three-quarters to two tons of natural ice—in certain cases even more. As one brewer expressed it as early as 1876, (Munich): "Artificial refrigeration possesses this advantage over natural ice refrigeration, that the whole quantity of cold produced is completely used, while there is always a loss of a considerable part of the cold in the employment of ice by reason of the cold water overflowing and being lost." Another in England said in 1878: "A machine rated at a production of five tons of solid ice per day has done, to accomplish the work it has performed, the equivalent of fully ten tons of natural ice. . . . . In 1877, this brewery was cooled down in half the time occupied when ice was used."

As a fair average, in ordinary practice, eight tons of solid ice per ton of coal is a good safe duty to count upon with a machine of any approved system; but in the condition in which such machines work in breweries double this duty can be obtained; that is, something like the equivalent of the melting of sixteen tons of natural ice, or more, per ton of coal burned. At the ordinary price of coal, and if we consider that the machine requires the attendance of but one engineer, as there is no ice to remove or to handle in any shape, it is easy to calculate that the cost of this cold artificially produced (per ton of really available cold) is much below any possible low cost of the natural product in any season or climate.

The different systems which have been proposed in order to utilize to the best advantage this "artificial" ice, used only as an incidental product in the conditions just stated, are of little interest now; since, for the last ten or fifteen years, or soon after the introduction of this machine in breweries, the cold produced by the machine has been directly applied in a much more efficacious manner. We will mention only the following, which presents some peculiarities because in some breweries (very few indeed) this practice of making artificial ice has been retained: It has been proposed to use one or more tanks of a capacity of forty to sixty cubic tons. In these tanks there should be two systems of piping, one for the purpose of producing the cold effect in the Baudelots, swimmers, etc., the other tubes being flues for conducting air through the tank, this air to be discharged in the cellars. By the action of the machine the fresh water of the tank is changed to a mass of ice containing its full value in cold, and is also a storage for all latent heat developed. If any accident or delay occurs in connection with the machine, the large quantity of new ice insures a sufficient supply of cold, even should the delay be prolonged for several hours. The congelation could be carried on at night by using the power not required during the day. This brings us naturally to artificial refrigeration as it is now practiced in breweries, which will be considered in future articles.

[TO BE CONTINUED.]

THE CHILLING OF BEER.

IT may be well at the present time to call attention once more to the influence of cold upon a mere infusion beer, says the London *Brewers' Journal*. We have done this season after season, and yet it seems as if the majority of brewers would never learn the very simple lesson that ordinary brewery produce secured on infusion lines of working carries a class of nitrogenous constituents of low solubility, that is, capable of passing out of solution either under the influence of drop in temperature or mere oxidation change. The unfortunate point in connection with this matter is that these nitrogenous bodies generally subside from solution in a very fine state of division, and consequently determine opalescence of very undesirable description, an opalescence that is far more easily noted by direct gaslight than when examining beer casually under ordinary circumstances. Another fact is that owing to their fine physical condition, such matters do not readily subside, and lastly, their tendency to redissolve again is very disappointing.

The racking temperature of an ordinary beer is about 58°; in most instances the difference between this and the storage temperature during cold, wintry weather is remarkably wide, and it is therefore quite common to note a drop of about 10° and even 15°. There are many brewers who, in consequence of this, take refuge in cold and long-continued storage, since beer so dealt with is capable of fairly quick recovery when moved into a warmer atmosphere; but if this is not possible, the surest safeguard is to be met with in early conditioning, since, as we have repeatedly pointed out, the beer is then producing its own heat, exactly as it does when undergoing natural fermentation in the open round.

The produce that chills most decidedly, or, rather, most disadvantageously, is that produced from heavy material, a fluid naturally enough imperfectly purged during the operations of the brewery; and, secondly, a beer that under similar circumstances remains persistently flat. The article that exhibits a prominent capacity of resisting drop in temperature, on the other hand, is obviously a stock beer that has been stored for some considerable period, and undergone during this storage further refinement, so that on the advent of cold weather it is in good gaseous condition.

We consider, therefore, that the store rooms should favor early conditioning of beer, this being a protection; if priming can be utilized successfully, this also has an influence, since sugar possesses, as we all know, a powerful solvent agency of its own, that tends to keep in solution matters that would otherwise subside. It is curious that certain chlorides play much the same part; and had it not been for the somewhat unfortunate influence of these saline substances on the phosphates of brewery produce, we imagine that they would have been very largely used for the purpose of preventing both sedimentary deposits and those appearances of dubious brightness that are more or less common during cold weather. They have, at any rate, been employed with much success in connection with the permanent brilliancy of hop bitters. In the case of stock produce, this may well be left to take its chance, since it is always stacked sufficiently long to recover from chilling, and even to exhibit benefit from the storage circumstances promoting this.

BREWERY REFRIGERATION NOTES.

——The Peter Hand Brewing Co., Chicago, will build a beer depot at Freeport, Ill.

——George Doehm, Harrisburg, Pa., is adding a refrigerating plant to his brewery.

——The ice house of the M. Robinson brewery, Scranton, Pa., was burned February 4.

——C. M. Conrad, brewer, Erie, Pa., is building an ice house 80×20×30, to hold 1,500 tons.

——John Smith's Sons, brewers, Youngstown, Ohio, have bought a 40-ton refrigerating machine.

——The Herl & Rendlen brewery, Hannibal, Mo., is setting up a 9-ton ice making machine, removed there from Nevada, Mo.

——Carl Lang has purchased, through the St. Louis agency, a 50-ton De La Vergne refrigerating machine for his brewery at Huntington, Ind.

——The Wahl Brewing Co., Quincy, Ill., will put in one 10-ton and one 15-ton ice machines to refrigerate their brewery and also to make ice for the local trade.

——The St. Louis office of the De La Vergne Refrigerating Machine Co., lately sold the 150-ton machine that was exhibited in Machinery hall, World's Fair, last summer, to the Western brewery, Belleville, Ill.

——The Vilter Manufacturing Co., Milwaukee, Wis., have closed a contract for a 300-ton refrigerating plant, including a Vilter improved 30×48×48 tandem compound Corliss engine to go into the brewery of the Val. Blatz Brewing Co., Milwaukee, making the fourth machine which the Vilter Manufacturing Co. has sold to the Val. Blatz Brewing Co., the others being two of 75 tons and one of 250 tons capacity, which have been in operation for several years.

[*Reprint from* JOURNAL OF FRANKLIN INSTITUTE.]

PIPE LINE REFRIGERATION.*

ARTIFICIAL REFRIGERATION THROUGH STREET PIPE LINES FROM CENTRAL STATIONS—THE DIFFICULTIES TO BE OVERCOME—ILLUSTRATIONS OF CHARACTERISTIC INSTALLATIONS.

By DAVID BRANSON.

THE methods of distribution from central stations through street pipe lines, or wires, of water, light, power, heat and speech, have all been made somewhat familiar to the public by years of common usage. That of distributing power to produce cold is known to comparatively few, and in its latest development, made during the past four years, is as yet almost unknown.

A popular idea prevails that we furnish cold air. As a matter of fact, we do not send out cold air or anything cold through our pipes. All such methods have been and must be financial failures, in spite of the most costly insulation, because of the percentage of loss of cooling power through absorption of heat from the earth or air through which the pipes pass.

Correctly speaking, our business is not to furnish anything; but to remove from the premises of our customers two things of which they wish to be rid: heat and humidity.

The most suitable material, as well as by far the cheapest, which can safely be used as a heat extractor is ammonia. It conveys heat to the central station, where the heat is disposed of through an application of cold water; and the water, after being thus loaded with heat, is ordinarily discharged into the sewer.

To make the illustration more clear to those having no knowledge of ice making or refrigerating machines, it might be well to explain by saying that expanding ammonia absorbs heat and that water absorbs ammonia, just as a sponge absorbs water. One might say that water is a sponge for ammonia and ammonia is a sponge to sop up heat.

Since the first practical development of artificial refrigeration and its application to the cooling of breweries and packing houses and to ice making, it has been the dream of many inventors, and also the aim of industrial promoters, to achieve a practical, safe and economical method of distributing refrigeration. Some twenty or more costly efforts to accomplish this result had been made in a dozen different cities, including Paris, London, New York, Boston, Louisville and Nashville. These resulted either in failure or in only partial success, but there was a great gain of valuable knowledge of the difficulties to be overcome, with little knowledge of how to overcome them, until five years ago, when Messrs. Starr, Thornburgh and Branson, the inventors of the system which we are to discuss this evening, undertook to study the causes of the failures of their predecessors.

Fortifying themselves with all the data that could be obtained, they experimented extensively, and visited many of the wrecks of other experiments.

The result has been a series of inventions which have been put into practical operation on a commercial scale in the cities of Denver and St. Louis. The plant in Denver was started on the eighth of August, four years ago, and has not been obliged to stop a single day since, though it has been twice enlarged and the street line extended. The street line in St. Louis has also been operated for more than three years. Both plants give such satisfaction to their patrons that many would not return to the use of natural ice could they procure it for nothing.

Let me quote from an able article by John E. Starr, which appeared in the *Engineering Magazine* for April, 1893:

"Up to the introduction of the pipe line system, only those who required large amounts of heat to be transferred could afford the appliances necessary to effect such transfer without using ice as an intermediary. To such large consumers of cooling power the introduction of ice machinery has been of incalculable value. In the brewing, meat packing, dairy and cold storage warehouse industries, the refrigerating machine saves annually millions of dollars, and renders possible operations on an enormous scale. To secure to the smaller consumer the benefits and to the vendor the profits of mechanical refrigeration was the problem of the pipe line engineer. The general economical advantages required to be preserved may be stated as follows:

"(1) The realization of enormous economy by operating in such a way as to transfer the heat directly from the customer to the central station without using ice as an intermediary.

"(2) The great economic advantages in distribution.

"(3) The general advantage of producing power on a large instead of on a small scale.

"(4) The commercial advantage of being able to offer to the smallest consumer of refrigeration all the benefits and economies of artificial refrigeration now obtained only by large consumers.

"To explain more specifically the first of the above considerations, it may be said that all refrigerating machines have two ratings, one known as their 'refrigerating capacity,' expressed by stating how much ice must be melted to produce an equal cooling effect; and the other as their 'ice making capacity.' The latter is usually placed, at the outside, at only 60 per cent of the former; that is to say, if we have a refrigerating machine that will produce as much cooling power as could be obtained from 100 tons of ice if placed directly at work on the space to be cooled, this machine would manufacture only sixty tons of ice. This may be more readily understood when it is remembered that in ice making the water which is to be frozen has first to be cooled by the machine from a temperature of 80° or 90° F. to the freezing point, before the process of congelation begins. This loss, together with the absorption of heat in and around the ice making tank, makes up the 40 per cent difference; and this is why all refrigerating machines are catalogued commercially with the two ratings mentioned.

"In the pipe line process the refrigerating machine is put directly at work on the spaces to be cooled. When a central plant has the equivalent of 100 tons of ice to deliver to its customers, the artificial ice plant has, with the same machine and the same expenditure in coal and engineer's wages, but sixty tons to deliver. This leads to the second consideration. The sixty tons of artificial ice, with the expense mentioned, are delivered only at the factory door. The 100 tons at the station have been delivered to the customers.

"The delivery of ice, even to large customers, is one of the principal factors of cost, while to smaller consum-

*Read at the stated meeting of the Institute, held at the Institute at Philadelphia, Pa., November 15, 1893.

ers, say of from fifty to 500 pounds per day, the delivery is by far the greater portion of the cost. The service of ice requires usually a team of horses, a wagon and two men for delivery in a comparatively limited district, and the cost of delivery by this method usually ranges from fifty cents per ton for the larger consumers up to $2.50 per ton for the users of small pieces of from ten to 200 pounds per day. This large 'operating cost' of delivery, which to the ice dealer is an item of expense becomes to the pipe line company an item of profit. The upkeep or repair account is little if any more by the pipe line method than by the horse and wagon system of delivery."

At the outset of our attempt to construct and operate our street pipe line system, we found that the principal obstacles were:

(1) The loss of power by absorption of heat from the earth.

(2) The difficulty of handling the constantly changing refrigerating load.

(3) The occasional stoppage of service of an entire district by reason of fire or breaks in the line, through accident or the necessity of making new connections.

(4) The automatic regulation of temperature.

(5) The leakage of the volatile material used as a refrigerating agent.

The absorption of heat from the earth is avoided by what is known as a direct expansion system, in which the liquid anhydrous ammonia (usually at a pressure of 150 pounds to the square inch at summer temperature), flows from the machine through one pipe (the liquid line) to the point of use, and is there expanded by being allowed to flow through a small hole in a carefully adjusted valve, capable of being regulated to suit the amount of refrigeration required. This expansion takes place in a coil of pipe within the space required to be cooled, which pipe is known as the expansion coil; and from this coil the anhydrous ammonia, now changed to a vapor, returns through a larger pipe (the vapor line) to the central station. By this system the entire cooling power of the machine is delivered and utilized in the refrigerators of the customers, none being lost on the way. The pipes, with the exception of the expansion coil, remain at the temperature of the ground or air through which they pass.

Our predecessors had managed fairly well to provide regular temperatures in large establishments under the changing conditions of the seasons or of day and night, by increasing or lessening the number of machines in operation or the speed at which a single machine was operated. But this had its limitations both financial and mechanical.

In the street pipe line business this difficulty is increased ten-fold. Experience soon taught us that no possible calculation could enable us to predict when the demand upon the machine would suddenly rise ten-fold, without a moment's warning, or as quickly fall to practically nothing.

To provide against this difficulty, we introduced one reservoir (for liquid anhydrous ammonia) at the outgoing end of the machine; a second reservoir (for strong aqua ammonia) at the incoming side of the machine; and a third (for weak aqua ammonia) which is usually placed at a higher elevation.

When the strong aqua ammonia reservoir is full, both others are empty, as their contents are supplied by the separation of the ammonia, or the greater part of it, from the water originally holding it in the strong aqua ammonia reservoir. The contents of this reservoir are pumped into the still at a uniform rate, and from the still the pure ammonia passes through the condensing coils to the reservoir for liquid anhydrous ammonia and the water or weak ammonia remaining flows to its reservoir above, each impelled by the pressure obtained from the heat of the distilling process.

The contents of the weak ammonia reservoir flow by gravity to the absorber automatically as required, and absorb the returning anhydrous ammonia vapor from the street line.

As we use what is known as an absorption machine (because compression machines have been found impracticable for this purpose), the anhydrous ammonia vapor returning from the line is first discharged into a tank of peculiar construction, called an absorber, where it is reunited with the weak aqua ammonia from which it was originally driven by distillation. When this aqua ammonia has absorbed all of the anhydrous ammonia vapor that it is capable of holding, it is automatically discharged into the reservoir for strong aqua ammonia, from which it is again pumped into what is known as the still or separator.

By this reservoir system several objects are accomplished; first, a machine of half the size that would otherwise be needed will answer for any required amount of service; as it will readily be seen that without the reservoir a machine would have to be of sufficient capacity to perform the service called for during the hottest hour of the hottest day, while during other hours a machine of one-tenth the capacity would often be ample.

In the reservoir system the machine operates steadily throughout the twenty-four hours, while the reservoirs vary in the amount of their contents alternately as the demand reaches a rate greater or less than the average of the machine.

This system also enables us to shut off the machine entirely for short periods to make repairs, and in cold weather to dispense with a night force entirely, allowing the reservoir and the absorber to work automatically, without attention.

Of course, in very large cities, multiples of the largest sized machine would be used with reservoirs of sufficient size to give steadiness to the operation of either machine and to permit of short stoppages.

[TO BE CONCLUDED.]

THAT the continent of Europe is passing through a cold period has been pointed out by M. Flammarion, the French astronomer. During the past six years the mean temperature of Paris has been about 2° below the normal, and Great Britain, Belgium, Spain, Italy, Austria and Germany have also been growing cold. The change seems to have been in progress in France for a long time, the growth of the vine having been forced far southward since the thirteenth century; and a similar cooling has been observed as far away as Rio de Janeiro, where the annual temperature has been going down for some years past.

——John W. Heafer and Jas. H. McGregor have formed a partnership in the ice trade at Bloomington, Ill.

[*Abstracted for* ICE AND REFRIGERATION.]

LEGAL MATTERS.

CONSTRUCTION OF A CONTRACT FOR FILLING AN ICE HOUSE—ICE COMPANY NOT BOUND FOR PAYMENT OF CONTRACTOR'S WAGES—MINOR LEGAL NOTES.

THE Supreme court of New York, in the recently decided case of *O'Neill* v. *Hudson Valley Ice Co.*, construes a contract for filling an ice house.

It seems from the statement of the facts in the case that a certain party, as agent, entered into a contract in writing with an ice company, in consideration of a certain sum per ton to scrape, cut, convey and house all the ice necessary to fill its ice house; to after the harvest return the company's tools and implements to it, to pay all expenses from start to finish, except for the coal necessary for the engine, to accept 75 per cent of the pay for the ice harvested weekly, and to do all things subject to the requirements of the ice company, which reserved the right to pay those employed on the contract, and to keep their time, and as soon as the job should be completed to pay the balance of the contract price. The ice furnished amounted at the contract price to $2,200, of which sum the ice company had paid $2,056.92 to the employes, leaving a balance on the contract price due from the company of $143.07. But the amount paid out does not appear to have covered the wages of the employes; and this action was apparently brought by an assignee of several of them to recover from the ice company the balance due for their labor.

It was insisted that the company was liable under this contract to pay the laborers on the job for all the work performed by them. This view was taken by the trial court, but the Supreme court reverses its judgment, holding that as a whole the contract will not bear any such construction. It is not quite clear why the provision that, "The party of the second part reserves the right to pay the men on the above contract and to keep the men's time," was incorporated in the contract, the court say but it is quite obvious that this volition reserved to the ice company could not have been intended to nullify the other provisions in the contract regulating the price for the work and obligating the agent referred to, or the unknown principal whom he represented, "to pay all the expense from start to finish," and turn the contract into an obligation of the ice company to pay according to their value the very expenses which the said agent contracted to pay. Nor would it authorize him, in employing men to perform the work, to bind the ice company by any statement made by him to them to pay for their services. Neither does this case, it is further held, come within the principle that when a party having money in his hands due to another pays part of the same on the debts of that other, a trust may be presumed in favor of other creditors. Nor can it be considered as a case where it is agreed to pay a third person for the benefit of another. There is here only a reservation of the privilege by the ice company to pay to the extent of its liability to the agent making the contract, or his principal. Moreover, statements made by such agent in employing men and promising them that the ice company would pay them are held not admissible in evidence, being in the nature of mere hearsay.

MINOR LEGAL NOTES.

——The New Jersey Ice Co., Hudson, N. Y., in an action for damages was found guilty and was assessed $2,500 damages in favor of James M. Sickles, whose son was drowned last winter by skating over thin ice which had formed where the company had been recently cutting ice.

——January 26, Shea & Strahle filed a bill in chancery court at Chattanooga, Tenn., asking for the appointing of a receiver for the Southern Ice Machine Co., which made an assignment September 9, 1892. The application is in the guise of a general creditor's bill and is filed for the alleged benefit of parties the defendant company is indebted to. It contains a clause asking for the attachment of all the properties of the company now in the hands of T. F. Stewart, trustee.

——The Crystal Ice Co., Youngstown, Ohio, on February 7, made an assignment to W. A. Porter. A stockholder has made a statement including the following facts: "The company started in business with a capital stock of $25,000. The stock was afterward increased to $50,000. Of this amount $23,000 was paid up. The indebtedness of the company is the difference between the capital, $50,000, and the amount paid up, $23,000, which is $27,000. The indebtedness of the company is embraced in what was paid for the plant. Outside of that there is practically nothing owing." The company will be reorganized with the capital stock doubled, and the business continued as usual.

LABOR TROUBLES.

——Ice harvesters at Oconomowoc, Wis., were paid $1.25 per day.

——Ice harvesters at Delavan, Wis., were paid $1.25 per day this season as against $1.75 last winter.

——The hands cutting ice for the Knickerbocker Ice Co., at Nyack, N. Y., struck for an increase of pay from $1.25 and $1.50 per day to $1.50 and $1.75. The demand was granted.

——The teamsters employed by A. B. Nicholas hauling ice from the Missouri river at Council Bluffs struck February 6, and as they would allow no one to work in their places a small riot seemed imminent until suppressed by the sheriff.

——For the first time in the history of the Knickerbocker Ice Co., says the Albany (N. Y.) *Argus*, they have reduced the wages of their employes. On February 8 the men were notified that after that they would receive but $1.25 per day, instead of $1.50, which they formerly received. The men accepted the terms.

——On February 18 the ice cutters for the Knickerbocker Ice Co., at Verpanck's Point, on the Hudson river, were notified of a reduction of wages from the rates usual for several years past; that is, $1,75 a day to experienced ice laborers, $2 a day to foremen and expert ice men, $1.50 a day to comparatively new laborers, and $1.25 and $1 to boys. The proposed cut in this scale gave men who got $1.75 a day, $1.50; the $1.50 men get $1.25; the $1.25 men get $1, and the $1 rate dropped to 75 cents. The men (300) refused to accept the new rates; called a meeting and appointed a conference committee to confer with the superintendent, who offered to compromise by giving the $1.75 men $1.62, which offer was refused. The company granted the demands of the men; that is, agreed to pay the old rate.

——The Boston Ice Co., at Mirror Lake, Dedham, Mass., February 16, had seventy-nine out of the 138 men employed strike for a raise in wages from $1.50 to $1.75 per day for ten hours' work. The Dedham police were summoned to the scene, but their services were not required, as those who quit work made no attempt to prevent or interfere with the work of those who declined to strike. Supt. Louis Smith, who is in charge of the men and work, said: "Good men are paid $1.75 and all others $1.50 per day. The men in the houses are paid $1.75; men on the runs get $1.50. When I hired the men I only agreed to pay them $1.50." The strikers say that the reason they struck was because part of the men were getting $1.75, and they believed all should receive the same amount. None of the strikers were paid off, and some of them weakened and returned to work, while a number of new men were put to work next day.

FIRE AND ACCIDENT RECORD.

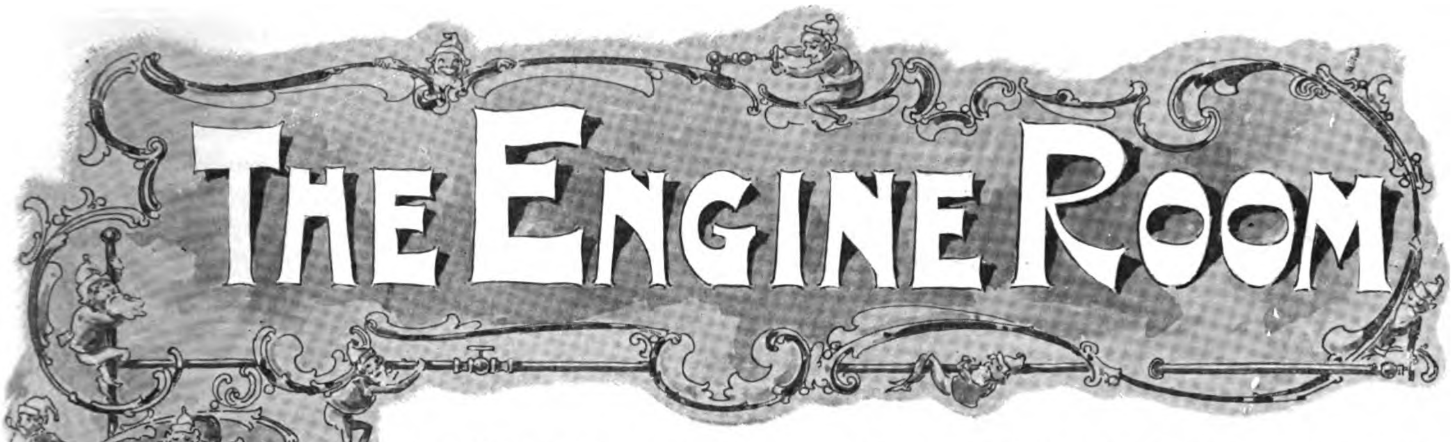
——F. Elsner's ice house at Remsen, Kan., was burned February 5; loss, $500; no insurance.

——The ice house of the Cincinnati Ice Co., at Loveland, Ohio, was burned January 30; loss, total.

The cold storage house of Joseph Roelkey, at Harmony Grove, Md., was burned February 7; loss, $3,000; insurance, $2,000; cause, incendiary.

——Seven ice houses of B. B. & R. Knight, at Dodgeville, leased by Carpenter & Sons, Providence, R. I., collapsed under a weight of snow January 30. The damage will exceed $2,000; the houses were empty, and repairs were begun at once.

——Geo. M. Moulton, president of the Produce Cold Storage Exchange, Chicago, has been elected Lieut.-colonel of the Second Inf. Regt., I. N. G.



[*Written for* ICE AND REFRIGERATION.]

CIRCULATION AND CONDENSATION.

THE VALUE OF CIRCULATION AND ITS APPLICATION TO STEAM MAKING—COMPARATIVE VALUE OF SUBMERGED AND ATMOSPHERIC CONDENSERS—CONDENSER SURFACE.

BY CHAS. DESMOND.

THE value of circulation and the different types of condensers employed in refrigerating plants are subject to frequent discussions among practical engineers and ice machine men. These points are of practical interest and value, as they have an important bearing on the economy of the plant.

Among the several systems of condensers which are found in refrigerating plants the one consisting of submerged pipes is, perhaps, the oldest and most simple, but is by no means the most efficient. Another and common type is one where the pipes are arranged horizontally with water flowing over the surface of the pipes. This type of condenser is found in several modified forms: One consisting of a number of pipes formed into coils and attached to headers; another consists of straight pipes connected by return bends at one end and at the other end are attached to a header, each pipe being provided with a drip to carry off the ammonia as fast as it liquefies. This form of condenser is sometimes arranged vertically. Still another form of condenser consists of concentric pipes arranged so that the water flows through the interior of the inside pipe and over the surface of the outer one the ammonia circulating between the two pipes. The condensing water after passing through the interior pipes is distributed in small streams over the exterior of the condenser.

The submerged condenser is a modification of the surface condenser, such as has been used on steam vessels from an early date, but by being submerged has lost a great deal of the efficiency which it originally possessed. Ammonia refrigeration is yet a new science, and in building it up to its present standard methods employed in other lines have been utilized so far as they were found suitable, and their value for this purpose can only be demonstrated by their service.

The submerged condenser lacks considerable of the efficiency due to the amount of cooling surface which it contains, owing to the lack of, or slow, circulation of the water surrounding it. The circulation thus obtained never becomes very rapid. Increased efficiency could easily be secured by forced circulation of the water, which could be obtained by the use of a pump. But such arrangement is not necessary, as much better results can be obtained from the same amount of piping if arranged to operate under different conditions. The difference in the capacity of water for absorption of heat is greater when the water is in rapid motion than when quiet, for the more rapid the flow of the fluid the greater the amount of heat radiated, or absorbed, as the case may be. Rapid flow of water means the use of a greater quantity in a given time, but the effect produced is also greater. Circulation is a very important factor, whether in making or condensing steam, or its use for heating purposes, or in the use of water for cooling or condensation. This has repeatedly been shown by experiments, the results of which are not so generally known as they should be. An understanding of the value of circulation may be obtained from the results of a few experiments, as here explained.

In steam making the same general principles are involved as in its condensation. In one case heat is applied; in the other, it is abstracted; and the same general principles are involved in refrigeration, where the ammonia is condensed by the cooling, or refrigerating, effect of water, and also the absorption of heat by the expansion of ammonia or the circulation of brine which has been cooled to a low temperature. The most effective experiment, probably, which has been made to show the beneficial effects of circulation was that tried with a common cylinder boiler which was suspended on trunnions so that it could be revolved over the fire. When the boiler was quiet the greatest effect that could be produced by rapid firing was the evaporation of a little more than five pounds of water per square foot of heating surface; but when the boiler was slowly revolved above the fire, the evaporation reached 11.5 pounds of water per square foot of heating surface per hour. In both tests that portion of the boiler below the water line was calculated as heating surface. Circulation being such a valuable factor in steam making, it should prove equally efficient in cooling or condensing.

The value of circulation in a steam boiler is recognized by nearly all manufacturers. An early practice in this line was to place as many tubes in the boiler as possible, and they were made of small size to get a large amount of heating surface, but as this arrangement interfered with the free circulation of the water, the expected results were not obtained. Successive improvements in steam boilers have been in the way of giving

better chance for free circulation by placing the tubes, in tubular boilers, farther apart and arranging them in vertical rows, both changes having resulted in greater efficiency in the use of heat. A further improvement has been made by removing a vertical row of tubes through the center whereby the circulation was less impeded. Increased results have also been obtained where larger tubes have been employed, although by this change the amount of heating surface for a boiler of given capacity has been lessened, while the evaporative efficiency instead of being decreased thereby has been increased. This result has been due in part to the increased efficiency in the application of heat in the larger tubes. The greater efficiency of tubes of larger size has been fully recognized in locomotive practice, and now-a-days tubes of very small diameter are not used in steam boilers. This principle will probably be found to apply equally as well in refrigeration as in the opposite practice; for there are many ice machine engineers who have used condensers which were built up of small pipes and others composed of larger pipes, but containing the same amount of surface, who give preference to the pipes of larger diameter. It is but just to say in this connection that all refrigerating engineers do not agree on this point.

Other experiments to determine the beneficial results of increased circulation, and its efficiency in steam making, have been made by the application of mechanical methods of forcing the circulation. In one case, a small propeller wheel was placed inside the boiler, at the back end near the bottom, so as just to clear the shell. The shaft led outside through a stuffing box, and a pulley was fitted to the shaft so that it could be driven by a belt. The boiler was first tested as to its evaporative power when the wheel was not in motion, and again when the propeller was revolving at a medium rate of speed. The results showed that with the forced circulation a greater weight of water could be evaporated per square foot of heating surface and per pound of coal, and that the water along the bottom of the boiler was kept at a higher temperature than when only natural circulation was employed. The above experiments were made by a ship building firm at Bay City, Mich. Forced circulation in a steam boiler has been applied in a different manner, but with equally good results, by Hiram Maxim, of electric light and rapid firing machine gun fame, who has patented the device. The inventive ability and good judgment of Hiram Maxim have been recognized by the world at large; but his recent efforts at producing a flying machine, operated by steam, have caused many to think that his energies were being applied in an erroneous manner. Maxim's device consists of a sort of injector placed inside the boiler, and operated by a water jet obtained by the rapid inflow of the feed water through the reducing nozzle. The feed water pressure is maintained at 180 pounds, and the high velocity given by its escape through the nozzle causes it to act on the injector principle, thus putting in motion a large volume of water (about twenty times the amount injected), which lies near the lower portion of the shell. The back pressure on the pump might, at first thought, appear as a detrimental feature, but the results obtained have shown, according to the reports, that a greatly increased production of steam could be obtained with economy.

The experiments above noticed have clearly proven the value of rapid circulation in steam making; and the difference in results obtained between condensers submerged in comparatively quiet water and those over which the water flows, have proved that the rapid circulation of the cooling, or heating, medium uniformly result in gain. In ammonia condensation great saving in the amount of water required for condensing purposes has been shown by the results obtained from the so-called atmospheric condenser in comparison with that required where the condensers are submerged. In the condensers exposed to the atmosphere, a small amount of water is caused to trickle over the exposed pipes, thus acting in a similar manner to that of water in circulation, but with the additional benefit of the circulation of air between and around the pipes, which assists in the vaporization of the water and the absorption of a large amount of heat.

The comparative value of submerged condensers and those which are exposed to the atmosphere was recently shown in a very decisive manner at the plant of the Western Refrigerating Works, in Chicago. This plant was using submerged condensers and was working at the rate of about 100 tons of refrigeration per day. The water for condensing purposes was obtained partly from an artesian well on the premises and partly from the city water supply. The cost of city water for the plant amounted to $14 per day, being at the rate of ten cents per 1,000 gallons. Condensers containing the same number of feet of pipe as the submerged condensers then in use were placed on the roof where they were exposed to the air and their increased efficiency was such that the supply of city water used for condensing purposes was cut off entirely, thus giving a very forcible illustration of the comparative economy of the two systems. This plant is equipped with four 50-ton machines, and the atmospheric condenser was in accordance with the capacity of the plant, or was rated at 150 tons. An addition of 100 tons capacity is now being made, and two condensers, each of 6,000 running feet of 1¼-inch pipe, will be supplied.

The amount of condensing surface required per ton of refrigeration is sometimes calculated at about twenty-six square feet; but by many this is not considered sufficient, as it has been found that thirty-five square feet per ton is more economical, and the new condensers, mentioned above, will be made on this basis. The small size of pipes in the condensers, it is considered, will give better results than pipes of larger size, as they will give a greater proportionate amount of cooling surface and the water expense will be reduced in a greater ratio than the increased cost of overcoming the friction in the pipes.

The proper circulation of ammonia through the condenser is a subject of interest to those having charge of refrigerating plants; and by some it is held that the common method of introducing the ammonia into the lower pipe of the condenser, causing it to travel upward in its tortuous course, meeting the coldest water after it has become considerably cooled, is not the best method which could be used, because it is inferred that better results could be obtained by introducing the ammonia at the top, letting the colder water meet the ammonia at the higher temperature, under which conditions the greatest amount of heat would be absorbed in the shortest space of time, and that the water flowing over the condenser,

although its temperature had been raised a few degrees, would still produce the same cooling effect and in a more economical manner. There is a question as to whether this would be an improvement; for it has been sufficiently well demonstrated that the transmission of heat is more rapid when the temperatures of the two substances vary by the greatest number of degrees. In applying the coldest water to the already cooled ammonia, the average difference of the temperatures is certainly greater under such conditions than would be the case if the colder water had been applied to the ammonia at the higher temperature and had thus absorbed heat and the temperature of the water been increased, leaving a less difference in temperature between the water and the partially cooled ammonia. By introducing the ammonia at the bottom of the condenser, the weight of the ammonia forced through the winding passages to the top of the condenser may cut some figure in the calculation, but as the liquid ammonia is trapped off as fast as it is produced, in many such condensers, a consideration of the weight of the ammonia would have but little effect on the final results, so far as economy of operation is concerned; in fact, it would be inappreciable. The great economy of the air condenser is further shown from the fact that a certain proportion of the water supplied is converted into vapor; and it is well known that to produce vapor a large amount of heat, which becomes latent, must be absorbed.

In the case of condensers composed of vertical pipes, which are coupled in pairs by return bends at the top and connect with a header at the bottom, the flow of the ammonia gas is through the first tube downward, where it is cooled by a comparatively strong flow of water; then, as it passes upward through the pipes on one side, it is further cooled and a large portion is liquefied, the liquid ammonia flowing back into the header and the remaining gas passing downward through the pipes on the opposite side, which are cooled by the water at its lowest temperature, and is there liquefied. With this kind of condenser, the water supplied to the first pipe, where the gas is at the highest temperature, it is nearly all vaporized, and consequently absorbs a greater number of heat units from the ammonia than if the temperature was not sufficient to produce vaporization, and an excessive supply of water is not required.

The so-called atmospheric condensers give better results and require less water if placed in a position where they are exposed to strong natural or artificial currents, for the air assists greatly in producing a reduction of temperature. In one plant it was noticed that the arrangement of the place was such that there was a fair current of air between the buildings at all times. The engineer had noticed that there was always a slight breeze at that point, and thought that something might be gained by placing the condenser there, and a platform to contain it was provided. After it was placed in this location the supply of water required for condensation was considerably reduced and the deposit of sediment on the pipes took place less rapidly.

The use of condensers of large dimensions is usually a source of economy, as it results in less water being required. Within reasonable limits, it would be practically impossible to get a condenser too large for economy. In St. Louis the size of condenser has been carried to such an extent that, it is claimed, no water is ever required for condensing purposes, the cooling effect being produced entirely by the atmosphere. This probably works very well and proves economical, for, although the ammonia would not be reduced to quite as low a temperature as though a certain amount of water was employed, yet the cost of fuel to produce the extra work required might be found cheaper than the use of water.

Air condensers have been used with steam engines, and have worked very satisfactorily. A steam motor for city railway purposes has been in operation in Chicago for some time, and the steam used in the engine is all condensed in pipes exposed to the atmosphere, while none escapes and no water is required for condensing purposes. The condenser on this motor is arranged on the roof of the car where it is always exposed to a current of air, it being due partly to the car being in motion. Atmospheric condensers for steam must be of rather large dimensions, as it is found that one square foot of radiating surface will condense 1½ pounds of steam per hour, and ordinarily twenty-five square feet of condensing surface is required per horse power—where the temperature of the atmosphere alone is relied on to produce the condensation.

For ammonia compression machines the dimensions of condenser need not be so great as the above, for the quantity of heat to be removed is considerably less than for steam. An approximation of the amount of surface required in a condenser can be calculated when it is known that about 2.75 units of heat is radiated per square foot of heating surface per degree difference of temperature per hour, knowing the number of pounds ammonia pumped into the condenser per hour, its temperature when leaving the compressor, and the fact that the specific heat of gaseous ammonia is about .5 that of air.

An atmospheric condenser will give better results, when uncovered and exposed to the elements, for then the air can circulate freely on all sides and between the pipes, producing the same efficiency by the use of less water than if the condenser was enclosed, even though doors and windows in plenty be provided to obtain a free circulation of air. Fully 25 per cent of the efficiency of the air is lost by inclosing such a condenser in any way. It is better to place the condenser on the roof of the building if possible and leave it unprotected (except, perhaps, by a roof to prevent the sun's says striking it direct), for it would be exposed only to air and the water of a rainfall, both of which will enhance the purpose for which it is provided. The deterioration of a condenser thus exposed will not cut much of a figure, compared with the increased benefits to be derived from the saving of water, where the amount of water used is much of an object. The circulation of air through and around an atmospheric condenser is fully as important, in an economical sense, as the circulation of water in a steam boiler; and the same may be said of the utility of circulation of the brine in the brine tank as well as through the pipes; and the same principle will apply to the ammonia, in the direct expansion system.

——The Consumers' Ice Co., Morristown, Pa., has elected the following directors for the ensuing year: Atwood Yeakle, R. Wilson Perry, C. J. Cloud, J. R. Yost, Daniel E. Houpt, M. F. Mack, Isaac Yeakle, Henry Arnoldy, Freas Styer, E. H. Brown, John Bedlow, Geo. W. Grady.

Written for ICE AND REFRIGERATION.]

POINTS ABOUT THE PLANT.

WEAR OF CYLINDER AND PISTON—CLEARANCE IN COMPRESSORS—INCREASING THE CAPACITY—NUMEROUS SUGGESTIONS AND THEIR PRACTICAL VALUE—THE PROPER METHOD.

BY OTTO LUHR.

THERE are many points about refrigerating and ice making machinery that deserve the closest attention of the engineer who wishes to operate the plant in the best and most efficient manner. These points do not necessarily include considering whether the compressor is of the single or double-acting type, arranged vertically or horizontally, as such things will adjust themselves all right enough if such machines are properly cared for and kept in good condition.

The downward wear and consequent leakage of the piston of a horizontal compressor is a subject which has called forth a great deal of argument and refined reasoning, while in practice it amounts to a mere trifle and is seldom or never noticed where the machinery is in charge of a competent engineer. The clearance in the compressor is of more importance, and is frequently neglected until the faulty working of the machine calls the attention particularly to that point. The natural wear of the crank and cross-head brasses amounts to considerable in the course of a few months, and is sufficient to greatly increase the clearance if the compressor is vertical and single-acting, while if double-acting the clearance at one end will be increased at the same time that it is reduced at the opposite end. The arrangement for keying up the brasses at either end of the connecting rod is sometimes such that the wear can be taken up equally at each end without changing the distance between the pins. When this is the case, considerable time will elapse before the clearance will be greatly affected. On some machines, where such arrangement is not provided, the wear will usually amount to enough to change the practical length of the connecting rod (that is, the distance between the pins) as much as one-eighth inch in the space of six months. A change of this extent would be sufficient to introduce an amount of clearance which would be a great detriment to economical compression, and if it took place in a double-acting cylinder might wreck a cylinder head or some other part of the machine.

If clearance be increased at one end of the cylinder and reduced at the other end, it cannot be said that the efficiency will remain the same, as what is lost at one end will be gained at the other. It does not work that way on an ammonia compressor. The clearance in compressor cylinders, as well as in the cylinder of the engine, should always be kept equally divided; but that it is not is shown by the repairs that have to be made.

Clearance marks should be made on the guides and cross-heads of engines and compressors to denote the limits of piston travel in each direction and also to show when the clearance is equalized at the ends of the cylinder. If such marks do not exist, or there is any doubt as to the truth of those which are found, the connecting rod should be disconnected at one end so that the piston can be pushed tight against each cylinder head and the position of cross-head on the guides marked at each end. These marks—one on the cross-head near the center, and one near each end of the guide—should be made plain and large enough to be seen and their respective positions noted when the cross-head is in motion, and still not be coarse enough to make it uncertain as to the comparative amount of clearance at either end of the cylinder. The distance which the piston clears the heads of the steam cylinder is subject to variation for the same reasons as with a compressor, and for another reason peculiar to the engine itself. Where engine and compressors are connected quarter-crank, or at an angle of 90°, the wear of the main journal bearing is greater in one direction than in any other. Where the compressor crank leads that of the engine, the greater amount of wear will take place during the outward stroke and will eventually amount to sufficient to put the engine out of line—enough to make it troublesome to keep it running cool and quiet. On some engines it will be noticed that the quarter brasses on one side only are fitted with adjusting screws. Usually these screws are on the side nearest the cylinder, when only one set is used.

If the engine is of the single crank type, such provision is not sufficient for keeping the engine shaft in line under all conditions of work, but will keep it nearly so if a driving belt pulls the shaft in that direction and causes an equal amount of wear on the out-board bearing. In other types of refrigerating machines the resistance usually produces unequal wear, so that the shaft will work out of line more or less in the course of time. A few gauge marks on cross-head, guides and certain portions of the frame serve an excellent purpose in assisting an engineer in keeping engine and compressors in line. To properly explain the use of such gauge marks would require illustrations which I cannot make at present, but will, probably, at some future time.

The proper proportions of the different parts of a refrigerating plant are fully as important as the kind of machinery employed and the attention it receives, for without the different parts having the right relation to one another efficient working cannot be obtained, no matter if the machinery is kept in the best condition. It is sometimes found that the condenser is so small that an excessive amount of work is required from the engine to produce the refrigeration necessary. Sometimes other parts may be badly proportioned, and losses result which could be easily avoided if it were not for the existence of such fault. Whenever a compression plant fails to work properly, the compressor is often selected as that part which is out of order, when in fact the trouble may be in the size of the brine tank, the condenser, or the insufficient amount of direct expansion surface.

Some time ago there was a case in hand where a brewery plant would not give the amount of refrigeration required and yet a careful calculation showed that the power and capacity of the compressors were amply sufficient for the purpose; still the work could not be obtained from the machines, as the plant was arranged. A careful examination of each part showed that considerable could be gained by increasing the size of condenser and brine tanks. The plan had been originally designed for 200 tons refrigeration, but machinery with a capacity of only 125 tons had been installed. This consisted of two machines, a 100-ton and a 25-ton compressors, but all other arrangements had been made for the use of machines with 200 tons capacity.

After it had been decided to increase the condensing and brine capacity numerous suggestions and any amount

of free advice were offered to assist in bringing the plant up to the requirements. An agent of one manufacturing company endeavored to demonstrate, by a volubility of words, that the compressor capacity was too small and that what was required was a 100-ton machine of the kind which he represented. Another suggested that the brine tanks be taken out and direct expansion be employed, the 100-ton machine being used to supply direct expansion to the brewery and the 25-ton machine to cool the beer. This plan was advanced with so much confidence,—and logic of a peculiar kind,—that it was considered with favor until a short calculation, dealing with British thermal units, served to show that the plan could not be utilized, because it would take too much time to cool the beer with a 25-ton machine. Another fault with that plan was that most of the refrigeration had to be done in the day time; that being the case, the plan could not succeed, unless some way was provided for storing up cold during the night time so that the supply could be drawn upon as required during the day.

One suggestion, which was offered without charge, was that another machine having vertical compressors be put in, because such were the only correct kind, as horizontal compressors always wore oval and would leak constantly; but that the vertical compressor, with its oil seal, would always be tight and moreovor there was no clearance for waste of power. This proposition contained some points worthy of investigation, if the claims could be verified, especially as both of the machines in the plant were of the horizontal type. One of the compressor cylinders being open at the time, it was thought advisable to ascertain the amount of wear which had taken place during the four years and more that the machine had been in operation, and at the same time to test the leakage of piston. The cylinder was carefully callipered, but without showing sufficient wear to be detected, or, in other words, what wear had occurred had been equally distributed, and the inside of the cylinder still preserved its circular form. Tests for leakage of piston showed that it did not exist in sufficient quantity to be detected by any means then employed. After this test was made in his presence, that agent was like the man in the song: "he never came back any more." Regarding the use of direct expansion, it was shown by calculation that if direct expansion was put in, the plant would need another compressor before the next summer had passed.

It is often an object, when a person has a project in mind, to get as much free advice on the subject as possible. This case was no exception; and after listening to many suggestions from those interested in the sale of machinery, and a few who did not expect to make anything out of the job, it was finally decided to add two brine tanks containing 8,000 running feet of 1¼-inch pipe, the piping in the cellars remaining the same, and also nine condensers, each containing twenty-four 2-inch pipes, twenty feet long, to be placed in the open air. This change was made; and during the following summer the 100-ton machine did all the work in a perfectly satisfactory manner, even after more work had been added to the refrigerating plant, and it was noticed that less fuel was used than ever before.

The above points are given in detail to show to men who are running refrigerating plants that they have just as good a right to know what is required and what the plant will do as men who are interested in the sale of new machinery or the furnishing of supplies; and they can know it and apply such knowledge if they will carefully study the principles and laws of refrigeration. These laws are not difficult to comprehend, and the equations may be readily understood, for the study of the subject has been made easy by the investigations and methods of such writers as De Volson Wood and George Richmond, the latter of whom is now giving a series of articles on the subject in ICE AND REFRIGERATION. These articles promise to cover every point in such calculations as are required in studying the subject of refrigeration in all of its practical bearings, and deal with the problems in a graphical way which is comparatively easy to understand, so far as the author has explained. By clearly understanding the principles and their practical application, the engineer will save much work for himself as well as expense for his employer, and avoid having an unnecessary amount of machinery to look after.

HANDLING BUTTER.

THE system of cold storage should be more thoroughly investigated by creamerymen, dairymen and farmers, says W. M. Benninger in the *Holstein Register:* "The cause of the low price of butter, eggs and all perishable farm produce is on account of the poor condition it reaches the markets, and by the sales being forced when there is no demand for it. The best time to sell any product is when you have buyers and when there is a demand for it.

"I have been running a creamery for nearly two years, which has only been profitable to my patrons, for whenever I had or could get plenty of milk and cream I could not sell my butter, and consequently I had on hand in a short time a lot of soft, strong and old butter, that would not only bring me less money than I paid for it in milk and cream, but at the same time ruined my best trade; and had it not been for my sweet cream and ice cream trade, I would have been obliged to close the creamery. Owing to these facts I looked upon the cold storage system, and came to the conclusion that the only thing for me was to get the best plan and build a cold storage. I at once opened correspondence with a number of builders, but must admit that the estimates I received gave me somewhat of a set-back.

"However, I could not give up the idea, so I secured the services of a refrigerator company, and had them send a foreman to put up the building, etc., and I now have a cold storage room that will hold twenty tons of butter, a good sized freezing room and an ice house that will hold over 250 tons of ice, the whole expense not being over $1,500. All I have to do to make the interest on my investment is to store 1,000 pounds of butter when the price is twenty cents per pound and keep it till the price is thirty cents per pound, and serve my trade with a much better product.

"I am fully convinced that the proper place for a cold storage is right at the creamery or on the farm, so that the butter can be stored right from the churn and worked without being exposed, and will reach the customer after keeping six months or more, so that no expert can tell it from fresh butter only a few days old, and summer or grass butter even better than fresh winter butter, and this, I am positive, cannot be done by the large wholesale and packing houses, as the butter is already old when it reaches them."

NEW BOOKS.

MECHANICAL REFRIGERATION. L. Sterne & Co., Ltd., Crown Iron Works, Glasgow and London. Paper, 48 pp. Free to the trade.

The manufacturers named have issued two pamphlets describing the De La Vergne refrigerating machine—one book devoted to icemaking, the other to refrigeration. The subject matter is therefore familiar to American readers. Accompanying the pamphlets some interesting circulars are forwarded also, describing late installations. The firm is making a specialty of small machines, with capacity of 100 pounds of ice per eight hours.

GENERALREGISTER DER JAHRESBERICHTE uber die Leistungen des Chemischen Technologie fuer die Baende XXI—XXX. Von Dr. F. Fischer. Leipzig: Verlag von Otto Wiegand, 1889. 8vo, paper; pp. 134. M. 6.

This is a comprehensive index which by subjects refers to every article contained in the annual reports on the progress of technological chemistry commenced by R. v. Wagner, and continued by Ferd. Fischer from 1874 to 1884. These reports are well known to our readers, and an index of this kind renders the treasures stored up in them all the more valuable and accessible.

GRUNDRISS DER ALLGEMEINEN THERMOCHEMIE. Von Max Plauck. Breslau: Verlag von Eduard Trewendt, 1893. 12mo, cloth; pp. 162. Price, M. 5.

This little work is a reprint from Ladenburg's extensive chemical encyclopedia, and will be a welcome aid not only to chemists, but also to those engaged in problems connected with the application of heat and cold for practical purposes, which all resolve themselves in chemical changes in the last end. The subject of thermochemistry or the application of thermodynamics to chemical facts and problems, which is generally referred to in a more casual manner in works on general and physical chemistry, is here treated independently in a short but fascinating and comprehensive manner, and the volume will be a great help to those who desire to obtain a more thorough insight into this rather modern branch of physics. The book also contains a full index of the literature on the subject and an appendix on the true inwardness of the second law of thermodynamics.

HANDBUCH DER CHEMISCHEN TECHNOLOGIE. Von Dr. Ferdinand Fischer. Leipzig: Verlag von Otto Weigand, 1893. 8vo, paper; pp. 1164. Price M. 15.

When a work like this has reached its fourteenth edition but little needs to be said in its praise, especially when, as is the case with this publication, it has acquired an international reputation. Although the whole vast subject of technological chemistry is here treated in one single (but pretty expansive, volume, yet all the essential points and facts are so thoroughly reviewed and in a manner at the same time so exhaustive and contracted, that it is not merely a text book, but a book for reference as well. About 100 pages of the book are devoted to the technology of the industries of fermentation alone, and furnish a complete review of this subject in all its ramifications. About 180 pages are devoted to the technology of fuel combustion, illumination, etc., a subject of quite universal interest. The other arts and industries, notably the production of food articles and the utilization of food products, likewise receive their due share of attention. The text is fully illustrated by over 700 wood cuts, and an elaborate index of twenty-four pages containing nearly 4,500 references is calculated to greatly increase the usefulness of the book.

ARCTIC MACHINE MANUFACTURING CO. CATALOGUE. Small 8vo; pp. 40. Free to the trade.

This handsome new catalogue is fully illustrated with halftones of machines and diagrams of parts of machines, model plants, etc. The descriptions are full and accurate and very conservative in statement.

STANDARD DICTIONARY. Funk & Wagnalls Co., New York, 18 and 20 Astor Place.

Volume I of the two-volume edition of the Funk & Wagnalls Standard Dictionary of the English language was issued on December 16. This volume has been four years in making; 238 editors and specialists have been employed upon it, and the cash outlay has been about $500,000. The advance orders for the work mount up into the tens of thousands. Indeed, the first edition was exhausted in less than a month. The dictionary was shown at the late World's Fair, the exhibit consisting of a number of proof sheets, as the work was only part in type, which fact makes the award given the dictionary more significant. The award of diploma and medal is the only class of awards granted. A gentleman who was present during the examination informs the publishers that the judges devoted nearly three hours to a critical inspection of the sheets (it was a very unusual thing to devote so much time to the examination of any exhibit), comparing the definitions with those of other dictionaries, and that they frequently expressed themselves as highly pleased and in favor of the features of the Standard. At the close of the examination one of the judges remarked: "I have the best of other dictionaries, but this work has desirable features that others have not. I must possess a copy when it is published." The full number of words and terms in the commonly used dictionaries for the entire alphabet is as follows: Stormonth, 50,000; Worcester, 105,000; Webster (International), 125,000; Century (six volumes, complete), 225,000; Standard, 300,000.

DYNAMO AND MOTOR BUILDING FOR AMATEURS. With Working Plans. By C. D. Parkhurst, Lieut. 4th Art., U. S. A., Ass. Memb. A. I. E. E., New York: The W. J. Johnston Co., Ltd., 41 Park Row, 1893. 32mo, pp. 163, 71 illustrations; price $1.00.

The book gives clear and concise instructions, accompanied by working drawings, for the construction of such forms and types of motors and dynamos as are simply made and yet will produce fairly efficient results. While primarily intended for the amateur, the detailed information, particularly in the chapters on armature windings, connections and currents and on the design of a 50-light dynamo, will be of value to every electrician. Full descriptions and workings drawings are given for the following machines: A small bi-polar shuttle armature motor of simple construction, capable of driving a small ventilating fan with current from a primary battery; sewing machine motors of simple construction, and one of more finished appearance and greater efficiency than the first, being of a regular factory made type; a dynamo of modern type, capable of lighting fifty 16-candle power lamps of 125 volts; a chapter on armature windings, connections and currents gives minute instructions, illustrated by drawings, in regard to these subjects, and based upon the latest and best practice. The chapter on the 50-candle power dynamo will be found instructive aside from the construction of the dynamo, as all of the technical points involved in the design are very fully treated, such as the proportioning of the armature and the armature wire, the calcylation of the magnetic circuit, etc. In an appendix data of some high-class dynamos and motors are given that will be of assistance as guides should the amateur wish to design any other types than those treated in the book.

ELECTRICAL LITERATURE. By Fred DeLand, 565 Rookery, Chicago, January, 1894. 16mo, pp. 28; price, 25c.

This is the second part of Mr. DeLand's most admirable index of current electrical literature, which the student and the editor will alike find invaluable in its field.

ICE COMPANY CONSOLIDATIONS.

——The North Jersey Ice Co., Newark, has consolidated with the Pocono Mountain Ice Co., of Pocono, Pa., and Richfield Springs, N. Y. Owing to lack of ice at Newark, the consolidated company cut at Gouldsboro and Tobyhanna, Pa.

——Messrs. A. L. and E. E. Howard have bought the controlling interest in the W. C. Howard Ice Co., of Watertown, Mass., and both companies will be managed as one and run jointly the coming year. The firm expects to harvest at least 12,000 tons before the season closes.

——The stock of the Hannibal Ice Co., Hannibal, Mo. (F. L. Dubach, owner), was purchased February 3 by the Creve Cœur Lake Ice Co., of St. Louis. The Hannibal Ice Co. owned sixty-eight acres of land on the bay with ice privileges on either side extending nearly, if not quite, a mile, a large ice house of 9,000 tons capacity, tools, etc., and about 6,500 tons of ice in the house. The new owners will enlarge the storage houses.

——A telegram from Chihuahua, Mexico, of January 23 to a Kansas City paper, says: "It is claimed here, by parties who are supposed to be on the inside of the deal, that as a result of the recent inspection of cattle and hogs on the ranges of northern Mexico by representatives of the Armour Packing Co. of Chicago and Kansas City, Mexico will soon have a southern branch of that large business. The inspectors sent to make an investigation into the stock-raising industry in Sonora and Chihuahua made a very thorough examination into the conditions of the business in the south. The high duty on imported meats and the increasing trade in this class of goods which Mexico is giving to the Armour company are the impelling factors which are causing these packers to seriously consider locating large establishments in this republic.

ICE & REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION, THE TEXAS ICE MANUFACTURERS ASSOCIATION AND THE FLORIDA ICE MANUFACTURERS ASSOCIATION.

·.· MARCH, 1894 ·.·

RATES OF SUBSCRIPTION.

IN ADVANCE, POSTAGE PREPAID.

United States, Canada and Mexico, - - - - $2.00 a Year
All other Countries, - - - - - - - - 3.00 "

Single copies 25 cents. Advertising rates on application to the offices. Remittances must be made by post-office orders, postal notes, international money orders, checks or drafts on New York, Chicago or London, payable to H. S. RICH & Co.

H. S. RICH   S. P. FOWLER   J. F. NICKERSON   JNO. GLENN COLLINS

H. S. RICH & CO.
PUBLISHERS,

177 La Salle St., Cor. Monroe, CHICAGO.
206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

*** ICE AND REFRIGERATION, at the World's Columbian Exposition, received a medal and diploma for editorial, typographical and artistic excellence—the highest award given to any trade journal at that Exposition.

*** ICE AND REFRIGERATION is issued promptly on the 1st of each month. The first advertising forms go to press on the 20th, and the last on the 27th or 28th. Changes in advertisements should be sent in before the 20th.

INDEX TO ADVERTISERS.

SOUTHERN ICE TRADE.

THE attention of the ice manufacturers of the South is called to official notice elsewhere of the adjourned meeting of the Southern Ice Exchange at Atlanta in April next; also to the report of the February meeting on another page.

The Southern Ice Exchange has been of much use to southern ice manufacturers; it can be made of still greater use, and by the operation of methods entirely legitimate. Those methods will be proposed at the coming meeting; and it behooves every manufacturer in the South Atlantic and Gulf states to attend that meeting and contribute to the discussion of those methods and to their adoption, if they seem to meet the requirements of the situation.

There is no legitimate reason why the ice trade of the South should be conducted year after year at a loss; yet it has been, generally speaking. Here and there a factory has been profitable; but as a rule the trade has been conducted at a loss. And this, too, almost entirely because of mere "child's play"—the juvenile principle of "getting even" with somebody for something. It would seem that the time has now arrived, after two or three years of losses, to stop it. The active members of the Southern Ice Exchange hope to do this; and they ask the co-operation of their colleagues in the trade. Let every manufacturer within the jurisdiction of the Exchange attend this most important meeting.

LOCATIONS.

THE thought sometimes occurs that investors in ice making machinery forget that ice making and ice selling is, in the main, a local business; that while no one can find fault with honest and honorable competition, yet it is a very easy matter to overdo the business, and deprive both competitors of a profit that one could earn.

It does not follow, by any means, that because one factory in a town of 10,000 to 15,000 people can be operated successfully, a second factory will be equally successful. Yet we have recently noted a couple of instances where 10-ton or 15-ton factories are being duplicated in towns under 15,000 people. This is like paralleling railroads or duplicating metropolitain gas plants: a waste of money, generally without any material advantage to the public; rather, the contrary, for if an investment of $25,000 will serve a town with ice, it is a disadvantage to them to have to support two investments of the same amount where one is sufficient. Either the investors must lose a part of or all the interest on their investment, or the public must pay an increased price for the service rendered them.

There are plenty of open locations now without doubling plants where one alone can earn only a reasonable profit. The subject is submitted to the "respectful and distinguished consideration" of the trade.

ANSWERS TO CORRESPONDENTS.

COLD STORAGE WITH ICE—THE PICTET ICE MACHINE—TIME FOR FREEZING ICE—ADDITIONAL GAS COOLING TANK—CLEANING CONDENSER PIPE—WEIGHT OF AMMONIA—SOLDERING FLUID, ETC.—CAPACITY OF COMPRESSOR.

[This department of ICE AND REFRIGERATION is conducted for the benefit of the trade generally, as well as individuals; and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

COLD STORAGE WITH ICE, ETC.

To the Editor: Will you please inform me as to the quantity of ice required to cool a room containing 1,000 cubic feet of space used for cold storage of butter and eggs? What temperature is required for proper keeping of these products? How many cubic feet are in one ton of ice? The room referred to above will be insulated with mineral wool sides, top and bottom, and the place for ice will be at the top. Is there a better location for the ice than at the top of the cooling room? A reply to above in ICE AND REFRIGERATION will greatly oblige, A. H. M.

ANSWER.—To keep the space at a temperature of from 32° to 36°, which is generally employed for cold storage purposes, it would require ice at the rate of 100 pounds for each twenty-four hours. Eggs may be kept at a temperature between 32° and 35° F. Butter will stand a somewhat higher temperature up to 38° F.; some keep it even at higher temperatures. By close figuring a ton of ice is found to occupy a space ~~of about~~ thirty-five cubic feet, but in storing ice little more room would have to be provided for. We think the best location for the ice is at the top of the cooling room.

THE PICTET ICE MACHINE.

To the Editor: I have a 3-ton Pictet machine, use anhydrous sulphurous oxide instead of ammonia. In place of refrigerator under the original style, I use a coil of piping 1¼-inch size to expand the acid in; had 1 inch, 200 feet of it, could only make one-half the capacity of machine in ice; can now make its full capacity. My idea is a further increase of said piping would add to its capacity. Wish your views on the matter. I find I cannot use much more than one-half the amount of acid that is rated as a full charge for the machine; have to use it sparingly into refrigerator coil from condenser coil, or it will freeze over on the pump and stop the valves from work. If I increase the expansion coil, will it not increase the expansion, and consequently make more ice? My directions say I should run with sixty pounds pressure and fifteen vacuum; I now run with ninety pounds pressure and twelve to fourteen vacuum. If I increase the amount of expansion coil, will it decrease the pressure or increase it, using the same amount of acid? How much of the 1¼-inch piping is best for my machine—3-ton? My idea is that my room for expansion is too limited, and I want to know if I cannot increase it, and thereby increase the output of the machine, and I can thereby lessen the pressure on the compression pump, or will the pressure be the same, using the same amount of acid without regard to the amount of expansion coil? I find the coil much better than the Pictet system of refrigeration, as the amount I have will make more ice and the danger of freezing the brine in the tubes of condenser is avoided; the brine, being on the outside of the pipe, cannot burst it by freezing, as in the other case, the brine being on the outside of the piping. I have solved the problem of making pure transparent ice by boiling pure spring water with the exhaust steam, and escaping the air when boiling, then cooling it for the ice molds. I am a subscriber to ICE AND REFRIGERATION, and prize it very highly; learn many things from it valuable to me. Please answer the questions within, and very much oblige. B. H. W.

ANSWER.—If we understand you correctly you claim that your Pictet ice machine could only be made to do half its duty when run with the original expansion coils, but that it did its full duty after larger expansion coils were put in. Now you think that by putting still more pipe into the refrigerator you can still increase the ice making capacity of your machine, and you expect us to give you figures as to how much more pipe and refrigerating room you should add, and to calculate what amount of additional refrigeration you would gain thereby. If you think this matter over you will doubtless realize that it would be rather presumptuous on our part to attempt to give such figures as you expect on the basis of scant information your letter contains with regard to your plant. Indeed, we should require a most thorough knowledge of your arrangements, and scarcely anything short of a personal inspection would warrant us to advise such a change in the face of the fact that builders of ice machines take the greatest pains to have the different parts of machinery in absolute harmony with each other. Of course your statements as to your experience, etc., are doubtless correct, and your conclusions therefrom are apparently quite logical; nevertheless, without knowing more about the case, we should suppose that something was wrong in the operation of your machine rather than to think that the builder should have made so radical a mistake in furnishing a refrigerator coil so much too small. There is doubtless something wrong (outside the size of expansion coils) for the pressure in the condenser coils should never reach ninety pounds if the temperature of your cooling water (which you do not state) is not unreasonably high. This abnormally high pressure, together with a deficient vacuum, and want of room for the full charge of acid, might lead us to believe that some foreign gases, probably air, occupies part of the space in your refrigerating system. Perhaps you have not investigated your plant with reference to this point, and if not we would advise you to do so before making further changes. If you should find our suspicions verified it would account in a great measure for the apparent disproportion in the size of the different working parts of your machinery.

TIME FOR FREEZING ICE.

To the Editor: We would ask you to be kind enough to give us what information you have on the length of time required to freeze cakes of ice of various sizes with the can system with a given temperature. Any reliable information that you can give us on this subject will be much appreciated. R. N. C.

ANSWER.—As far as we can learn, the best results in freezing artificial ice have been obtained by holding the brine bath at 14° F., and observations made on this basis have resulted in our establishing the following data: 11×22×28-inch ice will freeze solid in forty-eight hours with 14° brine; 11×22×40-inch ice will freeze solid in forty-eight hours with 14° brine; 11×11×28-inch ice will freeze solid in forty-two hours with 14° brine; 8×15×28-inch ice will freeze solid in forty hours with 14° brine; 8×8×28-inch ice will freeze solid in thirty-six hours with 14° brine.

The longer the ice is congealing the better looking it will be, *i. e.*, 17° to 19° brine will freeze the ice much slower, but will make much prettier ice; there is, however, no practical economy in the slow frozen ice; 14° brine will make the most satisfactory ice all around.

Square ice freezes quicker than oblong sizes and turns out prettier ice, but up to the present time the trade seems to prefer the oblong sizes, 8×15-inch and 11×22-inch being the sizes given the preference, on account of the sizes of standard ice boxes being suitable for these sizes of ice.

ADDITIONAL GAS COOLING TANK.

To the Editor: I propose to make some improvements on my plant with a view to economizing cooling water, and would

like to have your opinion on same as explicit as you can give it. Under present arrangements of plant the water flows away from the weak liquor tank at a temperature of 100° to 104° F. Suppose I catch this water and carry it to another cooling tank placed below the weak liquor tank and containing a coil connected with pipe from retort, so that the ammonia vapors have to pass this additional cooling tank first, whence they are led upward again to pass through the regular or original cooling tank already provided for in my plant, and which is always fed by fresh cooling water from the well. As the water would enter the additional cooling tank at a temperature below that of the ammonia vapor coming from the retort, would I not derive considerable benefit from passing gas through it, before the latter enters the regular cooling tank? Would I be troubled with a collection of water of ammonia in the additional tank, because of its having to be placed about twenty-five feet below the original gas cooling tank? Would gravity and friction interfere seriously with pressure in gas collector from which it is discharged into refrigerating coils? Please estimate increase of capacity in a 10-ton absorption plant using ninety gallons cooling water per minute at temperature of 80° F., as it comes from wells.

A. O. F.

ANSWER.—Your idea for economizing cooling water is doubtless correct, theoretically speaking; at the same time we think that your fears regarding the collection of ammonia water in the tank or cooling system which you propose to add, and friction in pipes, etc., are well founded. If an additional tank is to be used in the manner proposed by you, it should, if anywhere, be placed above the original gas condensing tank, so that the ammonia drippings that may be formed can find their way readily back into the retort. In this case the water leaving the weak ammonia liquor tank would have to be lifted to the level of the proposed tank, and most likely the original gas cooling tank would have to be lowered to make room for the proposed new gas cooling tank, and this again might interfere with the proper back flow of drippings which may be formed in the original gas cooling tank. These points all must be looked after in making such changes as you propose. The increase of capacity that might be obtained by your proposed improvement depends on circumstances. If under present working conditions your machine turns out its full capacity, or nearly so, you will not gain much in this direction, but your gain will be in the direction of requiring less cooling water. If, as you seem to suppose, you would be able to utilize the same amount of cooling water as before (ninety gallons per minute), but make the same to leave your refrigerating system at a higher temperature, you would gain about one-half ton in refrigerating capacity for every degree that the temperature of the cooling water leaving the machine is higher than it was before when working the old way. But, as we understand it, this can only happen if your machine is not worked up to its full capacity, otherwise you will only need less cooling water. In this connection we may not be amiss in calling your attention to a system of cooling or recooling condenser water by a process of gradation carried out by Messrs. A. Reummeli-Hacker & Co., of St. Louis, Mo.

CLEANING CONDENSER PIPE.

To the Editor: Will you please answer this question in your next issue: What will clean or take off the scale from condenser pipes?

O. I. C.

ANSWER.—Not knowing the nature of the scale that has formed on your condenser pipes, it is rather difficult to give a definite answer to your question. In a general way it may be said that if the sediment does not adhere too firmly to the pipes the best method would be to chip it off by gentle pounding, using a chisel, if necessary, perhaps here and there. But if the sediment adheres too firmly, so that chemical solvents must be used to remove the scales, its composition cuts a great figure. The composition of the scale, of course, is governed by the composition of the cooling water, but as a general rule the scale may be supposed to be composed largely of carbonates of lime, magnesia and iron. Sediments of this kind can be dissolved by various acids, but all these acids, even in the diluted state in which they must be used for this purpose, attack also the iron of the coils, and for this reason great care has to be exercised in employing them. We should use either diluted sulphuric acid or diluted muriatic acid, but some patience has to be observed in the application, as the acid works only by degrees. After all, if you can chip the scale off with any degree of expedience it will prove to be the more satisfactory way, we think.

WEIGHT OF AMMONIA.

To the Editor: What is the weight of a cubic foot of liquid anhydrous ammonia? Does the weight vary with the temperature and how much? Also, does the volume of gas from the same vary with the temperature and pressure? O. E. V.

ANSWER.—One cubic foot of liquid ammonia weighs about 40.87 pounds. The weight of liquid ammonia, like that of all other substances, varies with the temperature; the same is the case with ammonia gas or vapor. The variations are fully laid down in a table published in ICE AND REFRIGERATION at various times, among others in Vol. II, page 110.

SOLDERING FLUID, ETC.

To the Editor: In the February part of ICE AND REFRIGERATION I notice an article written by Chas. Desmond on "Leakage of Coils and Brine Tanks." I consider that the information is given in better form than it usually is in books or journals; but one thing I would like to ask Mr. Desmond, to wit: What proportion of sal ammoniac would he mix with, say, half a tumbler of soldering fluid, "muriatic acid cut with zinc"? the size of a pea, of a hickory nut or of a walnut? Also, how would an absorption machine act should the poor liquor get over into the expansion pipes?

W. W.

ANSWER.—To one-half tumblerful of soldering fluid add a piece of sal ammoniac as large as a medium sized hickory nut; the exact amount can be varied without perceptibly affecting the result. If the poor liquor should get into the expansion pipes in large quantity, it would greatly affect the working of the plant, as no refrigerating action could be obtained. If such a thing occurs as the poor liquor passing the separator, there is something wrong with that portion of the apparatus, and it should be examined and the difficulty removed. Defective action on an absorption machine may be due to the presence of bad gas, which can be detected by the odor and its strongly inflammable qualities. An explicit description of how the plant operates and the length of time since it has been charged will greatly assist in arriving at a conclusion regarding the cause of defective action.

CAPACITY OF COMPRESSOR.

To the Editor: We have a 6×12-inch ammonia compressor, running 120 revolutions per minute; water in our condenser, 65° F.; gauge pressure in condensing coils, 120; back pressure in brine coils, 15; gauge pressure our brine, 18; inlet water into condenser, 65°; outlet 80° F. At the above figures, what would be the capacity of this compressor? Please answer in your March issue of ICE AND REFRIGERATION.

S. B.

ANSWER.—You do not state in your question whether your compressor is single or double-acting. Assuming

the former, and allowing for back pressure, fifteen pounds gauge pressure, that is, thirty pounds absolute (corresponding to a temperature of 0° F.), and for condenser pressure 120 pounds gauge pressure, that is, 135 pounds absolute (corresponding to a temperature of 72°), the theoretical refrigerating capacity of your compressor sums up as follows:

The cooling effect of one pound of ammonia vapor passing the compressor under the cited conditions is equal to—

$$556-(72\times 1.1)=477 \text{ units,}$$

in round figures, 1.1 being the specific heat of liquid ammonia.

The capacity of your compressor, allowing the usual percentage for clearance, is about 0.184 cubic feet, and therefore the ammonia passing the compresser in twenty-four hours equals

$$\frac{0.184\times 120\times 60\times 24}{9.2} = 3456 \text{ pounds.}$$

And hence the refrigerating capacity expressed in tons of ice—

$$\frac{3456\times 477}{142\times 2000} = 5.8 \text{ tons.}$$

TRADE CORRESPONDENCE.

A BRILLIANT RECORD—INFORMATION WANTED—A REPORT ON TRADE.

[The publishers of ICE AND REFRIGERATION do not hold themselves responsible for the opinions expressed by correspondents on any topic; but these columns are at all times open for the discussion of subjects of interest to the trade, and such correspondence is at all times welcomed. Our readers are cordially invited to contribute to this department by giving their views on questions propounded, or by suggesting original topics for trade discussion, or notes on the condition of trade in their section of the country. Anonymous letters will receive no attention whatever.—ED.]

A BRILLIANT RECORD.

To the Editor: I write to challenge any one to show a similar report to the one given below:

Last year from this little 6-ton mill I sold $6,910 of ice, and not one dollar nor one cent is due me from any one in or out of town, and we ship about half we make. I do a strictly cash business here in the city, and thirty days on the shipping trade, and never let up on a man until he pays us, if we have to write to him twenty times.

If out of town bills are not paid by the 5th of each month, we stop shipping. I see personally each one of my customers about twice a year, and find out all about them individually and what people say of them in their own town. We have made nothing in the past two years, having to spend everything on this old used-up mill to keep it going, and we wish some one would put up a new one here, as my lease on this is up December next. Out of $8,500 last year I lost but $26. Am now on my third year.

W. N. FLANDERS, *Manager.*

GREENVILLE, S. C., Jan. 25, 1894.

INFORMATION WANTED.

To the Editor: Do you know of any device by which we can keep our expansion pressure the same at all times—some automatic arrangement? We find our engineer will neglect his expansion valve more or less, and as it is very important that this pressure be maintained, in ice making, at a certain point, we think an automatic valve of this sort would sell like "hot cakes" and prove a very useful article. If you know of any such valve please put us on to it. Wishing you the success your journal highly deserves.

G. S. B.

[If any reader can supply the information we should be pleased to receive and publish it for the benefit of the trade in general.—ED.]

A REPORT ON TRADE.

To the Editor: The prospects for a good season in ice are very fair at this time, as no ice has been housed in this vicinity. Last winter there were at least 2,000 tons ice put up in this town and the immediate vicinity. Yours very truly,

PETERSBURGH, VA., February 24, 1894. J. B. WORTH CO.

C. W. BIESE, Pres., Chattanooga, Tenn. M. BENJAMIN, Vice-Pres., Atlanta, Ga. C. F. SUGG, Sec'y & Treas. Huntsville, Ala.

SOUTHERN ICE EXCHANGE.

SECRETARY AND TREASURER'S OFFICE.

HUNTSVILLE, ALA., Feb. 24, 1894.

There will be an adjourned meeting of the Southern Ice Exchange held at the Kimball house, Atlanta, Ga., April 11 and 12, for the election of officers and for discussion and consideration of matters of the utmost importance to every ice manufacturer, especially matters pertaining to prices and territory, so that we can avoid, if possible, this season the unsatisfactory results of the past two seasons. You are urgently requested to be represented at this meeting, as only by having a large and representative attendance can the desired results be accomplished, for "in union there is strength."

C. F. SUGG.
Secretary and Treasurer.

ICY ITEMS.

——Shepp & Knapp, of New York, have purchased the Vreeland lake houses of the Saddle River Ice Co., Paterson, N. J., and will continue the business.

——The Haledon Lake Ice Co., Paterson, N. J., has been incorporated; capital, $20,000; incorporators, Phineas, John and Elizabeth Bridge and Frank Van Cleve.

——The St. Louis agency of the De La Vergne Refrigerating Machine Co. has sold a 100-ton machine to be erected for T. M. Sinclair & Co., packers, Cedar Rapids, Iowa.

——The New Bedford (Mass.) Ice Co. has elected Simeon Hawes president for 1894; Geo. H. Paul, treasurer and clerk; Isaac L. Ashley, Simeon Hawes and T. C. Hatch directors.

——J. M. Drew has sold out so much of his ice business as is located on the upper side of the railroad track, including Cottage, Main, School and Cross streets, Athol, Mass., also his Lake Ellis ice house.

——The Salem Spring Ice Co. has been incorporated at Naugatuck, Conn.; capital, $5,000; incorporators, James L. Murphy, Patrick Brennan, M. D. Coen, Kate Coen, J. A. Maher and J. H. Dunn.

——Chas. B. Dunn, on February 16, purchased at receiver's sale the property of the Diamond Ice Co., of Paterson, for $800, assuming the incumbrances. The property must again be sold to collect other claims.

——The Orange (N. J.) Distilled Water Ice Co. has elected the following officers for the coming year: President, John O. Heald; vice-president and secretary, William E. Condit; treasurer, Thomas J. Smith.

——The Kiechler Mfg. Co. has been licensed by Jas. A. Smith, Sr., inventor and patentee, as sole manufacturers of the Smith patent ribbed ice can. The licensees have put in special machinery to facilitate their manufacture, and will be prepared to fill orders after March 15.

——The Jacob Dold Packing Co., Kansas City, has made a contract with the Peninsular Car Co., Detroit, for fifty refrigerator cars, in which cars the Standard Paint Co.'s new insulator, "Ruberoid" will be used for roofs and floors, 28,000 square feet of which has already been used.

——The ice manufacturing plants at Indianapolis, Ind., have been now running to their full capacity, and the Crystal Ice Co., which is erecting a new plant, has assurance that all the ice it can manufacture will be needed for this market. There is but little of last year's natural ice crop held over.

——The Mobile (Ala.) Ice Co. on February 5 elected the following officers for the ensuing year: I. P. Hart, Savannah, Ga., president; Samuel Lapham, Charleston, S. C., treasurer; A. S. Lyons, Mobile, secretary. The following were elected directors: A. S. Lyons, S. L. Whitesides, Samuel Lapham, W. H. Brown, of Columbus, Ga., A. N. Hill, of Savannah, Ga., R. W. Hopkins, of Boston, Mass., L. P. Hart, Savannah.

——The newly elected officers of the Ice Manufacturing and Cold Storage Co., of Columbus, Ohio, are as follows: President, L. D. Hagerty; vice-president, W. B. Page; secretary and treasurer, William Bott; manager, Vic R. Roehm; directors, L. D. Hagerty, W. B. Page, William Bott, Charles Whealen, William Kiefaber, John T. Barlow and Charles H. Halsey. At the late annual meeting a 2 per cent cash dividend was declared and the balance of a dividend of 10 per cent will be expended in new machinery.

[*Written for* ICE AND REFRIGERATION.]

TIGHT JOINTS.

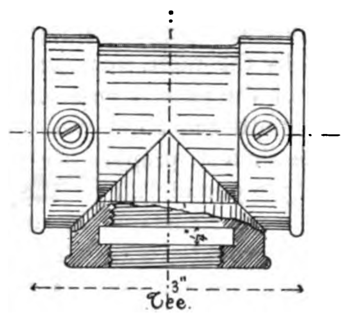
AN INVESTIGATION INTO A NEW METHOD OF PREVENTING LEAKS IN PIPE JOINTS—SOME TESTS MADE BY THE AUTHOR UNDER QUITE SEVERE CONDITIONS.

BY AUGUST J. ROSSI, B. S., C. E.

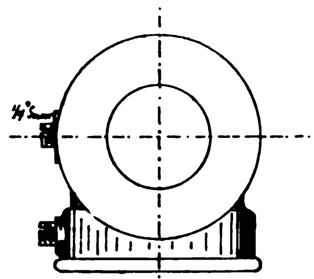
WITHIN the past two years there has been introduced on the market a certain class of fittings called "The Tight Joint" fittings, which present more than a casual interest. Having had occasion to report on this class of fittings as used in refrigerating machines, and hearing that this method had proved successful under the severest tests of pressure to which the joints had been submitted, and also that before these joints could be made to leak the metal of the fittings themselves or of the surrounding parts gave way under the strain, I made an investigation of their merits and experimented upon them; and I desire in this present article to describe their principal features, recording briefly the results obtained, believing that by so doing I may be of service to persons interested in artificial refrigeration, for which purpose the fittings in question are particularly well adapted, not only for such parts of the machinery as bear directly on the production of cold, but as well for others, such as the steam engine, boiler connections, steam, water, brine and liquids in circulation and pumps. The investigation applied to all sorts of fittings, tees, elbows, return bends, couplings, flange unions, reducers, etc. Moreover, these fittings, like any others, are obtainable on demand and can be had for each class, reducing from any given diameter to any other, a feature of the highest importance for the engineer who, desiring to use them or experiment with them, might have doubts as to his ability to obtain such sizes of the new fittings as can be had of the ordinary ones.

I will take an elbow as an example, in describing the distinctive features of the fitting. The method consists in boring in that part of the fitting which is threaded to receive the connecting parts, a small recess about $\frac{3}{16}$-inch deep and ¼-inch wide, as shown in the cuts, in which is afterward cast some lead intended to form a ring in the recess. A hole about ¼-inch in diameter reaches from the outside of the fitting to this recess. Whenever the fitting is of a larger diameter, two, three or more of such openings are provided on the circumference of the recess at proper distances. In these openings, which are threaded and through which the lead intended to form the ring is cast, are screwed small set screws which pressing on the surface of the lead of the ring, force it to flow, so to speak, on the thread of the fitting and of the pipe screwed in, rendering the joint absolutely tight.

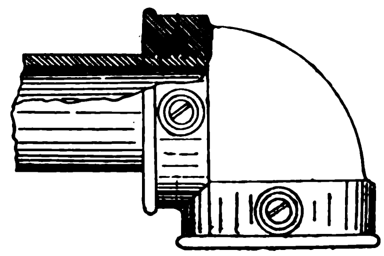
It was claimed and I found it to be a fact, that if a fitting should leak under pressure, a gentle tightening of the set screw would stop the leak. Moreover, I found it was not even necessary that the pipe be tightly screwed in the fitting (though of course advisable) as a slight turn of the set screws would stop the leak thus invited. That this method, simple as it is, is effective in insuring tightness can be surmised from the fact that in experiments with these joints in official tests at the Navy Yard in Brooklyn, the screwing of a pipe in the fitting having been made by hand, the turning of the set screws was enough to stop a leak thus purposely produced under a pressure of 240 pounds of steam to the square inch, the joints remained tight and dry. Under a pressure of 1,100 pounds liquid petroleum, leaks purposely created were similarly stopped. Under 1,800 pounds hydraulic pressure the same tightness was secured, and finally 3,300 pounds were reached and held. Experiments of the same kind made at the Stevens Institute of Technology (Hoboken), but much more severe, have furnished entirely corroborative results. The joints, the set screws once set after a leak had been produced, held 300 pounds steam pressure, 300 pounds ammonia gas pressure, 1,700 pounds air pressure, 3,000 pounds refined petroleum pressure gradually increased to 10,000 pounds and 12,700 pounds per square inch. In another case the joint stood without leakage 16,000 pounds and 17,800 pounds hydraulic pressure, at which last named figure the metal of the fitting used, and that of the connecting



Tee.



Elevation



Elbow

parts, began actually to swell and to pull apart. In other tests the joints were submitted to a pressure of 300 pounds of air under water, then lifted out from the tank, heated by the passage of steam and dipped again into water, when immediately after 300 pounds air pressure was applied. Under these alternations of heating and cooling (a severe test) no leaks could be detected. In still another case 1,500 pounds air pressure was held without loss for six weeks. In short, these experiments show the tightness secured by the use of the method and its efficiency under pressures which were actually pushed, in some cases, to the extreme limit of resistance of the metal composing the fittings themselves and of that of the parts connected with them.

My own tests were made in special view of the application of these fittings to refrigerating machines. Some were tested on the condenser of an ammonia compression machine. On the main supply pipe of the condenser, provided with a stop cock, was screwed a "Tight Joint" tee, the two open ends of the tee being securely plugged. Opening the cock on the pipe leading to the condenser, the screws of the fitting were loosened until a good leak of ammonia was obtained. Then the set

screws, having been but slightly set up, and the whole fitting well wiped off until all smell of ammonia had disappeared, moistened red litmus paper was applied on each of the joints. No blue coloration, such as indicates the presence of alkalies, was observed. Moistened yellow curcuma paper was applied in its turn. No brown coloration indicating the presence of alkalies was noticed. Then trusting to the absence of pungent odor, or the ordinary detecting agents for alkalies, the joint was apparently tight; but, by applying on the joints moistened pieces of "phenolphtalein" paper, a very delicate test for alkalies, by means of which the faintest traces of these compounds can be detected in a solution, a faint pink coloration was plainly visible. The set screws were then very gently tightened, whereupon not even by rubbing the white "phenolphtalein" paper against the joints, could any coloration of the test paper be produced. This was, chemically speaking, as severe a test as could be applied to the joints. The pressure in the condenser, owing to the temperature of the cold water used for condensing purposes, was not over 130 pounds, but as in other tests, with ammonia pressure of 175 pounds, 185 pounds and 200 pounds, just as complete a tightness of the joints was obtained by the mere working of the set screws. The efficiency of the joint is apparent.

In the same establishment another machine was being put under what is called the air test, preparatory to its being started, and 300 and 310 pounds air pressure through the whole apparatus were registered on the gauge. The condenser coils were provided with "Tight Joint" return bends, and the compression and aspiration connecting pipes of the gas pump (three inches in diameter) were connected with "Tight Joint" elbows. All these parts, under water, did not show any sign of a leak after three hours, the screws once properly set.

Experiments of the same nature were made before us on the steam part of the machinery. Leakages of steam purposly started under pressures of 85 to 100 pounds per square inch, allowing the steam to escape with a hissing noise, were immediately stopped by the tightening of the set screws. Not only was this result obtained, but the manner in which, when the lead of the ring has been (so to speak) squeezed out from the reach of the set screws by repeated tightenings of this kind for sake of demonstration, it can be rendered effective again, is as ingenious as it is simple. It is enough to drop in the hole, which receives the set screws, a small plug of lead wire of the proper diameter, provided for such purpose; then by again making use of the set screws, the effect is instantaneous. We consider this of great importance.

In another experiment water was compressed through one of these joints connected with a pipe screwed by hand, and shaking almost loose in the fitting. Even under 1,500 pounds pressure, the leaks thus purposely invited were stopped immediately by turning the set screws. The pressure having been carried to 3,000 pounds hydraulic pressure, leaks created intentionally were stopped in the same manner. Under 5,000 pounds petroleum pressure, identical results were obtained.

These experiments, made by me and in my presence, appear to me conclusive as to the particular fitness of these joints for use in artificial refrigeration. Any engineer who has had practice with refrigerating machines knows by experience the difficulties attending the renewal or even the tightening of a joint when it becomes necessary in such parts of the machine as are not easily accessible; especially when the pungent smell of a volatile liquid interferes with working. To tighten a joint under pressure is a delicate operation. With this kind of joint the turning of the set screws is all that is required to stop a leak, and as already mentioned, fresh lead can be supplied from the outside through the hole reaching the recess to secure the tightness of a joint, occasion for which, it is said, scarcely ever occurs. In the same line of applications, it is a well known fact that in air machines a leak means more than the mere escape of gas. It has a direct bearing on the efficiency. In our modern days, when volatile liquids having the highest tension, such as carbonic dioxide, ethylen nitrous oxide, even oxygen and hydrogen, nitrogen and air itself, are liquefied and kept in that state in special vessels, and are used as such for special purposes of intense refrigeration, or are kept as gases in these receptacles under enormous pressures for special uses, the possibility of making the joints of the fittings perfectly tight and the security thus realized acquires a considerable importance.

I have had to examine certain systems of refrigeration for towns in which street pipe lines were proposed, through which pipes it was intended that liquefied ammonia or carbonic acid should circulate for purposes of refrigeration by expansion of the liquids in coils at each house, very much as steam is supplied for heating purposes, from a central station. Leaving aside all considerations of adaptability or efficiency of such systems, it appeared to me that one of the greatest objections to their practical application would be the difficulty of handling carbonic acid (a liquid probably best adapted for such purposes, on account of its not having a disagreeable smell and its relative cheapness), because the enormous pressures required to keep it in the liquid form in these pipes would reach 800 to 1,100 pounds per square inch. If we consider that the supply pipes would have to be laid under ground in the streets in narrow trenches, it seems that a leak once started in one of the pipe joints could not be very easily stopped, however good the fitting might be, on account of the scantiness of room in such trenches. With these joints this would not prove a difficulty. Compressed air for motive power on a large scale has been proposed in certain cities, and even for purposes of refrigeration, and certain applications of this system on a small scale are now in operation, the method of supply being the same as for steam. The pneumatic tube is used currently for sending dispatches and packages in Paris and elsewhere. For such purposes the necessity for joints either absolutely tight or easily made so, if leaking, is obvious. I am pleased to learn that these new joints are more expensive than others used for like purposes, while on the score of efficiency they evidently deserve the attention and investigation of engineers.

——C. G. Swanson has leased his ice houses at Mankato, Minn., to F. B. Swanson for a year.

——Mr. Ledoux E. Smith has been appointed manager of the ice factory at Alexandria, La., taking charge on February 1.

——Freeman & Co., of Chicago, have purchased the Hammond company's fifteen ice houses at Sheboygan bay, Wis. The capacity of the plant is 45,000 tons.

——The Hercules Bronze and Galvanized Iron Works, Chicago, succeeds the Tierney Manufacturing Co., as manufacturers of ice cans, bronze ingots, anti-friction Babbitt metals, etc.

THE ice harvest of 1894 may be set down as yielding a good average crop, which, on the whole, has cost about the average amount per ton; that is, considerably more than the cost of last year's cut per ton. Maine has filled its empty houses; New England has done pretty well, especially the northern counties; New York state as a whole is not so well supplied as usual, and the ice has cost more to house, being thinner than good ice should be; the Hudson river houses are pretty well filled up; the Central states (Pennsylvania, New Jersey, and Ohio) have generally been compelled to go north for ice, to the cutting cost of which freight must be added; the Northwestern states have full crops, but central and southern Indiana, Illinois, Missouri, etc., have had to go to Wisconsin and Michigan for their domestic ice, though Kansas City's packing houses and the dealers along the Missouri have gotten a fair crop under roof. Except in the extreme north the ice is under twelve inches thick, sometimes of good quality but not always so. This, in brief, seems to be the situation with dates up to February 20: An average stock of only average quality is in store, with conditions favorable for a healthy business. There seems to be little room for purely speculative ventures. It would be tedious to make mention of every fact that has come to hand in connection with the harvest; but some hasty details illustrative of the situation may interest.

CHICAGO'S ice will be both local and Wisconsin lake. Up to February 1 there was practically no ice south of Wisconsin, and the dealers opened up and filled their houses there, or largely so, and a number of new houses were built hastily. In February, however, a crop was made at home of fairly good quality, when the Wisconsin harvesters were called off. The best ice to be sold in the city, however, will be the Wisconsin crop, which is ample for all possible demands. The local ice is seven to ten inches thick, but the cut at the north Indiana fields is by no means as large as usual.

WISCONSIN has enjoyed one of her "old time" ice "booms." The lack of ice in the territory south of the state line turned all eyes to the multitude of lakes on her railroads, which have had good ice (north of Madison) since December. Nearly every house has been filled; thousands of tons have gone south to St. Louis, and a great deal was cut early in February for Chicago, though later the city dealers found supplies near home. The packers also of Chicago, Omaha and Kansas City have made large cuts in this territory, and several eastern railroads have come here for supplies. The ice runs from twelve to twenty-four inches in thickness and is very fine in quality.

MICHIGAN has supplied Ohio and central and southern Indiana. The crop came in very late, it being the middle of February before dealers south of the Grand Rapids line, or even that city, began to get a crop at home. The fields in the northern part of the state then began to show activity, and it is estimated that $500,000 worth of ice has been sent to Ohio and Indiana from that territory. Vicksburg has cut large quantities for Detroit, Kalamazoo and other towns, as well as for shipment. Cadillac also cut large quantities for outside towns.

THE Ohio and Pennsylvania crop is light, the lake towns only having made anything like a crop, and this small in quantity and under the average quality. Toledo's stock is under the average, even including the amount held over from last year; Cleveland's stock also is short; the interior towns got considerable four to six-inch ice, while Cincinnati's crop was partially a failure. All the ice factories in the state are running at full capacity. Pennsylvania's reports are meager, but indicate a short crop.

NEW ENGLAND is fairly well supplied with ice, though in Connecticut and Rhode Island the harvest came very late, and the crop is much under the average in both quantity and quality. The Massachusetts harvest has generally been good, and all the leading towns and cities appear to have all the ice that will be needed.

MAINE was very much "in the dumps" until the middle of January showed but little new ice on the Hudson and none south of Philadelphia, when the field brightened up and the old time activity came on again. Orders from the southern companies to fill the houses began coming in as early as January 15 and the six weeks succeeding have been very busy ones. Both on the Penobscot and the Kennebec the houses have been filled by the established firms, who look forward to a prosperous and profitable season. The soft weather and the heavy snows made the harvest at times a harder one than usual, but the crop in the house at this time has seldom if ever been excelled for quality.

MISSOURI and the Missouri river territory, Kansas, Nebraska, etc., began cutting in a tentative way late in January, but the ice was thin and very poor in quality, owing to alternating thawing and freezing. Soon after February opened another thaw came, stopping work until the 15th, when the harvest was resumed. An average crop was housed, and is rather better in quality than expected.

IOWA, in the main, got enough ice in the interior towns. The river crop, however, was not up to the average. Dubuque got a crop in December and January, but at Keokuk, a very important harvesting center, the cut was interrupted by thaws, Coey & Co., the largest dealers, having gotten by February 8 only 13,000 out of 17,000 tons desired. Sioux City got a full crop of over 30,000 tons, and has shipped a large quantity.

IN the far west the California and Utah cut was as great as usual and Montana and the northern tier of states obtained the supply needed. Colorado, however, especially at Denver, did less well than a year ago.

THE New York state crop is not up to requirements, if an opinion can be based on advices up to February 20. The weather has been very unsettled, and while ice was made prior to January 1, the month of January was a

succession of thaws alternating with snow and cold weather, so that except in a few localities but little ice had been housed until after February 1. Troy began cutting as early as December, and has been cutting, off and on, ever since, having by February 10 had about 150,000 tons in the house. Buffalo began cutting thin ice about February 6, on 8- to 10-inch ice, and has a fair crop of that sort. Albany has cut some ice at home, and will go north for the balance. The interior towns report considerable thin ice housed.

The Hudson river harvest has been in progress for a month or more through all sorts of weather; and, with an estimated stock left over of 800,000 tons, it would be a wild statement to say that the river crop is a "failure," notwithstanding it is not equal to last year either in size or character. On February 19 Mr. Maclay, of the Knickerbocker Ice Co., New York, said: "Our total full harvest at all points is about 1,200,000 tons. We have been at work now, off and on, about one month so far this season. We are idle at most points now, because of snow and unfavorable weather. We have gathered some inferior ice in order to make sure of getting as full a crop as possible. That will not affect the price of ice for household use, as it does well enough for refrigerating purposes, but would not answer for making ice water." Other river towns have put in every available hour on the crop, but it is not possible with our present advices to say just what is the actual condition. A fair estimate would put it at probably three-quarters of a full crop—say a good average. There will be no real shortage in the city and probably not in the state, though the condition of things at Syracuse and Rochester, and a few other large inland cities, is not now definitely known to us.

NEWS OF THE HARVEST.

——J. M. Rouse at Saratoga Springs, N. Y., has housed 20,000 tons, of fine quality, thirteen to fourteen inches thick.

——Mankato, Minn., had housed about 20,000 tons prior to February 1; ice from fifteen to twenty inches thick and very clear.

——The Arctic Ice Co., Newport, R. I., housed about 2,500 tons, which, with the amount held over, will be sufficient for the season.

——Ice on Ottawa river, Canada, was eighteen to twenty-two inches this year against twenty-four to thirty-two inches a year ago.

——Hannibal and Quincy dealers, cutting on the Mississippi, February 19, abandoned the hope of getting a full crop. Some ice has been housed, however, of indifferent quality.

——Before January 21 the Hudson Valley Ice Co., Albany, N. Y., had cut 20,000 tons of pond ice fifteen inches thick, and on that day began harvesting the second crop, as well as ice from the lumber slips on the river.

——The Boston Ice Co. started in about February 1 at Lake Quannapowitt, Wakefield, with 200 men, and housed 75,000 tons. At Milton, N. H., the same company harvested 450,000 tons, and at North Chelmsford housed 50,000 tons, all this being at least twelve inches thick and of good quality.

——In the neighborhood of Troy, N. Y., pond and canal harvesting began in December of 9-inch ice. Two weeks later 14,000 tons had been housed at Green island, all the houses at Warrensburg had been filled, from Loughberry lake 15,000 tons had been cut, and a number of minor houses were filled.

——At Madison, Wis., the American Ice Co., Chicago, bought an 800-feet frontage on Lake Waubesa on which to erect a house; Esch Bros. & Rabe, Chicago, whose regular houses are at Yorkville, Ill., have built six houses (each 180×36×32 feet) on Lake Monona; Ramsey & Lerdall have sold their house on Lake Mendota to Kurz & Haegel, Chicago, who who built a house 235×160×35 feet; Swift & Co. have built on Lake Waubesa; the Lincoln and Knickerbocker companies have had houses here for several years; the National Ice Co., Chicago, was hunting land in January; and Wm. Denison, at West Madison, had cut for shipment to Chicago. A Chicago dealer here said recently: "If the railroads will cut down the freight to even 80c. per ton, not less than 200,000 tons of ice will find its way into Chicago this winter."

NATURAL ICE NOTES.

——The Twin Lakes Ice Co., Chicago, has built new houses at Elkhart, Wis.

——Jos. Covell, Dolgerville, N. J., has built an ice house to hold 12,000 tons.

——The Detroit Ice Co. have built a house at Pontiac, Mich., 170×80 feet.

——Tupper & Retallick, Troy, N. Y., have built an 8,000-ton house at the Junction.

——Manchester, N. H., cut about 40,000 tons this season, beginning January 15.

——The Washington Ice Co., Chicago, has built a large house at Okauchee, Wis.

——Hannibal, Mo., has two ice machines at work, and also 20,000 tons of natural ice in store.

——Houghton, French & Co., of Orion, have built a house at Pontiac, Mich., 61×177×24 feet.

——Thos. Elder and A. G. Austin have leased the ice business of Hough & Moore, Butte City, Ariz.

——The Channel Ice Co., Moline, Ill., built in February a new house above Demock, 40×100×22 feet.

——Mr. Ellis, Newton Centre, Mass., has put in a new planer, manufactured by J. N. Briggs, Coeymans, N. Y.

——Sloan & McGovern is a new firm in the ice trade at Butte, Mont., and have 3,500 tons in their houses at Silver Bow Junction.

——Swan & Fisher (Independent Ice Co.), Lynn, Mass., have housed 10,000 tons, all planed with a J. N. Briggs patent power ice planer.

——A new company has been organized at Toledo, Ohio, to cut ice at Gard Island. Some of the men interested are Robinson Locke, W. L. Hoyt and R. B. Thomas.

——J. P. Smith & Co., Chicago, will erect permanent ice houses at Lake Geneva, Wis. Four rooms will be built and filled this winter, to which additions will be made in the future.

——Plans have been prepared for a second ice house to be erected in the C. P. R. yard at Winnipeg, Manitoba, which will be utilized in replenishing the supplies for refrigerator cars.

——Terence, Thomas and Bernard Brady, New Brunswick, N. J., who have been doing business as Brady Bros., have incorporated as the New Brunswick Coal, Ice and Lumber Co.; capital stock, $60,000.

——Thos. G. Poole and Wm. Burke have built a house at Fulton, N. Y., 50×100 feet in size, and T. D. Lewis and J. H. Case also have built another to hold 7,000 tons. The ice on the canal and river has been sold to dealers at the rate of $25 per acre.

——New ice houses of moderate size and additions to existing houses have been recently built by the following: S. H. Howe, Thawville, Ill.; R. D. Harrison, Elkhorn, Wis.; W. P. Brown, Cumberland Centre, Me.; John Farnham, Grange, N. H.; W. S. Cates, Machiasport, Me.; John Pollock, North Lawrence, Ohio; P. J. Mullarkey, Silver Springs, N. Y.; F. W. Karsten, Springfield, S. D,; Jesse L. Drowns, Sandown, N. H.; Arthur Jordan, Champaign, Ill.; P. Gibson, South Ryegate, Vt.; Geo. H. Barnes, Berlin, Mass.; D. L. Ransom, West Windsor, Vt.; H. W. Holmes, Hillsdale, N. Y.; B. N. Clark, Sheffield, Mass.; Geo. Gillett, Sylvania, Wis.; C. B. Williams, Marshalltown, Iowa; F. L. Herrick, Roxbury, Vt.; Chas. Whiting, Clarksfield, Ohio; Lloyd Nash, Westport, Conn.; A. L. Roth, Canton, Ill.; W. N. Henry, Clinton, Iowa; Jas. F. Osterhoudt, Katrine, N. Y.; Henry Ernst, Bowmanstown, Pa.; C. J. Chandler & Co., Chelsea, Mich.; Barney Flynn, Bismarck, N. D; Geo. Everitt, Webster City, Iowa; Leslie Claflin, Mason, N. H.; John Farnham, Pilot Heights, N. H.; W. Heckler, Tower City, Pa.; B. Sherman, Littleton, N. H.; Homer Goodwin, Darlington, Ohio; T. F. Kearney, W. Troy (Junction), N. Y.; Chas. Ledez, Otterburne, Manitoba; Cunningham Bros., Hadley, Mass.; H. A. Beidler, Williams Bay, Wis.

——John Collier, New Brunswick, N. J., whose ice house was burned some months ago, has rebuilt in a more substantial manner. The plant now consists of an ice house with three rooms, capable of holding 4,000 tons of ice, a fireproof engine house, a brick stable, a wagon shed and a complete blacksmith and wheelwright shop, with a storage room for lumber and useful odds and ends. All the buildings were constructed at a cost of nearly $12,000. The ice house is ninety feet long, thirty feet wide and about forty feet high. It is built with inner and outer walls of hemlock, filled in with sawdust; has two elevators, each of which will lift a ton of ice to any height, and are worked by an improved hoisting engine, located in a sheet iron engine house a few rods from the ice house. The wagon shed will hold nearly twenty wagons, the repairs on which are made in a finely equipped blacksmith and wheelwright shop, seventy feet long, thirty wide and two stories high. To the rear of the ice house is the brick stable and barn for twenty horses. It is fitted up with large stalls and has a board floor. The second floor contains the oat bin, and storage for loose and baled hay. The building is fifty feet long and twenty-five wide. In the construction of all the buildings the greatest precaution has been taken against fire. They are lighted throughout by electricity, and all, with the exception of the ice house, are roofed with corrugated iron. The wheelwright and blacksmith shop is built entirely of iron.

THE outlook for ice machine work continues to be very favorable, on the whole. Our record of new work for the month in the factory and cold storage line is as follows:

ALABAMA.

Montgomery.—The establishment of a cold storage plant is being agitated by some members of the Commercial and Industrial Association.

ARKANSAS.

Rogers.—King Bros. have purchased a 6-ton "Hercules" ice making machine to be ready for this season's work.

ARIZONA.

Phoenix.—A local paper says: "A prominent ice manufacturer of New Orleans is in the city with a view of erecting a new and extensive ice plant. But Phœnix has two good institutions of this kind already who sell an excellent article at very low prices."

CALIFORNIA.

Folsom.—The ice factory at the penitentiary was started up on January 26. C. W. O'Laine is in charge of the plant.

FLORIDA.

Jasper.—An ice factory is to be built here.

Key West.—It is announced that Mr. John R. Scott has completed arrangements to organize a new company for the manufacture of pure ice in Key West. The members of the company are the Acme Brewing Co., A. & N. M. Block, distillers, R. H. Plant,banker, Macon Ice and Fish Co., of Macon, Ga.; the Sulzer-Vogt Ice Machine Co., of Louisville, Ky., the Armour Packing Co., of Chicago, Ill.; and S. M. Brown, capitalist, of Columbus, Ga. The Pure Ice company has been merged into the new company, which is capitalized at $60,000. A new ice plant has also been purchased, capable of manufacturing twenty tons more of ice per day. This machine will be in operation on or before the first of April of this year. It is the intention of the company to devote considerable attention to the development of the fish industry in Key West.

Palm Beach.—G. G. Springer, of St. Augustine, is erecting an ice factory. It was the intention to have this factory running by March 1.

GEORGIA.

Augusta.—The Augusta Ice Co. is putting in a 25-ton ice machine, which will double the capacity of the old plant.

Cuthbert.—An ice factory and cold storage plant will be built by Abraham Jones.

Rome.—The Rome Ice Co. is making extensive improvements which will practically rearrange the whole plant The work will cost about $1,500, and will be completed some time in March. The daily output will be increased from ten to fifteen tons.

Waynesboro.—Sheriff Hurst is building a cold storage house.

ILLINOIS.

Aurora.—A movement has been started to form a stock company for the construction of a suitable plant and building, which according to present plans will cost $22,500 exclusive of a site. The latter will probably be donated by some of the local real estate syndicates. The ice plant and equipment will be made by the Hercules Ice Machine Co.

Champaign.—A movement is on foot to build an ice factory; and indications are that it will be successful. G. B. Storer, of Anderson, Ind., is interested.

Chicago.—Western Refrigerating Co. have contracted with Westerlin & Campbell, Chicago, for two additional 100-ton improved ammonia condensers to be run in connection with their Linde machines. This is the second order for these condensers, the contractors having previously furnished two of 50-ton capacity each to this plant.

Duquoin.—Local capitalists are "talking ice factory."

Galesburg.—The Galesburg Artificial Ice Co. has been organized and has made arrangements with Westinghouse, Church, Kerr & Co., Boston, for the machinery, a 25-ton plant. The plant will be located on the C., B. & Q. railway, where shipments can be made to outside towns. It is intended to erect a number of cold storage rooms to rent to parties needing such facilities where any desired temperature will be kept at all times day and night. The capital stock of the company is $80,000. The buildings will be three in number. A large one, forty by seventy feet, will contain the equipment for the manufacture of ice. The engine room will be twenty by forty feet. The ice house will have a capacity of 1,000 tons.

Kewaunee.—Is "talking ice factory."

Macomb.—Local capitalists will establish an ice factory to cost $12,000 to $14,000 and have an output of about ten tons per day.

INDIANA.

Elwood.—It looks as though this city would have two new ice factories. On the 7th the City Ice Co. (Kramer Bros.) announced that they would erect a 15-ton plant at once on North Anderson street. Next day Phil. Hamm & Co. announced that they had completed arrangements for a plant to be built on Fourteenth street.

Lebanon.—A company to put up an ice factory has been organized with $30,000 capital stock. Mr. Neal, of Neal & Perkins, is temporary president, and W. J. De Vol, secretary and treasurer. The plant will have a capacity of twenty tons daily, with three cold storage rooms. It will be run in connection with the electric light plant.

Marion.—Spencer & Van Gorder will build an ice factory. Work will be commenced on the buildings at once, which will be 35×80, with engine room and storage house 20×40. The plant is expected to turn out twenty tons of ice per day. The water supply will be from well similar to the water works wells, which will be put down where the plant is located. The company expect the plant to cost them in the neighborhood of $25,000, and want to be making ice by the first of April.

Wabash.—Henry Baumbauer is trying to organize an ice factory company in this city.

INDIAN TERRITORY.

El Reno.—N. B. Trulock, of Pine Bluff, Ark., contemplates building an ice factory here.

KANSAS.

Anthony.—G. R. Landers, president of the Electric Light Co., is considering the advisability of erecting an ice machine in connection with his electric plant.

Coffeyville.—Harding & Gay (mentioned last month) have turned over their ice factory scheme here to Hoffman & Co. (Chas. Hoffman, Coffeyville, and F. M. Lewis, Parsons), who have contracted for a 25-ton plant, to be running by April 1. Mr. Lewis will have charge of the plant.

Fredonia.—The Southern Kansas Ice Co. has filed its charter with the secretary of state of Kansas. The corporation is formed to establish ice plants and cold storehouses in different parts of the state. The places of business of the company are Fredonia, Coffeyville, Independence, Cherryvale, Neodesha, Oswego, Columbus and Chanute. The directors are H. B. Harding, S. S. Kirkpatrick, Ben S. Paulen, C. J. Burton, of Fredonia, and C. M. Gay, of Carthage, Mo. The capital stock is $10,000.

Independence.—The Vilter Manufacturing Co., Milwaukee, has sold to Messrs. Gay & Harding, of this city, one 50-ton ice machine with 17×42-inch Vilter improved Corliss engine. Work has begun on the building (on the Santa Fe track), to be 42×130 feet, eight feet high.

MARYLAND.

Cumberland.—The Cumberland Ice Mfg. Co., have purchased land in order to enlarge their plant by adding 15-tons capacity.

Hagerstown.—A new ice company, called the Bester Ice Co., has been organized here with the following officers: President, Lewis Delamarter; vice-president, Wm. Bester; secretary, J. A. Spielman; treasurer, B. F. Beck; superintendent, Wm Bester. A committee was appointed February 11 to purchase the necessary machinery, and it is expected that the new factory will be in running order by May 1, and ready to furnish the trade. The water from the Hamilton spring will be used for condensing purposes.

Martinsburg.—Is "talking ice factory."

Westminster.—The Ice and Cold Storage Co., of Westminster, has been organized; capital, $10,000; officers, president, John L. Reifsnider; secretary, Joseph W. Smith; treasurer, Denton S. Gehr. The directors are Edward Lynch, George W. Albaugh, Francis H. Orendorff, A. C. Strasburger, Jos. D. Brooks, F. Thos. Babylon, George R. Gehr, Fred. D. Miller and Chas. H. Vanderford. To secure co-operation of the whole community in the enterprise, the shares were placed at $10 each, and all the people were invited to subscribe, the stock being payable in five monthly installments of $2 each. The plant is to have a capacity of twenty tons.

MASSACHUSETTS.

Mattapan.—The Dorchester Hygeia Ice Co. are pushing the work on their factory on Oakland street near the N. Y. & N. E. railroad. The company expect to be ready to deliver ice about March 1, much of the machinery having been set up prior to February 1.

MICHIGAN.

Brooklyn.—Chas. Kinsler has just completed here, at a cost of nearly $3,000, one of the A. I. Dexter patent cold storage buildings. There is only one other of the same kind in Michigan. It takes eight car loads of ice to fill the ice chamber.

Grand Rapids.—Charles F. Gifford, Chicago, has prepared plans for a cold storage plant to be erected here by L. H. Austin during the coming spring at a cost of $5,000. It will be refrigerated with the Jackson system and will consume 240 tons of ice during the summer.

Marquette.—Martin & Campbell have nearly completed the erection of a $12,000 cold storage warehouse here.

MISSISSIPPI.

McComb City.—Negotiations are pending for the purchase of lots on which an ice factory will be built.

MISSOURI.

Clinton.—The Lamar ice plant is to be moved to this city. It originally cost $23,000, and was bought from St. Louis parties by the Clinton men for $16,000. The capacity is ten tons per day.

De Soto.—Work has begun on the buildings for the new ice factory, ground having been broken February 20.

Kansas City.—The Kansas City Ice and Cold Storage Co. filed articles of incorporation February 14; capital stock, $50,000. It is owned by A. J. Morris, of St. Louis; O. W. Butt, A. Menny and M. H. Gray, of Kansas City. The purpose is to carry on the ice and cold storage bnsiness.

Monett.—The Monett Electric Light, Power and Ice Co. has purchased a 40-ton "Hercules" ice making machine.

Ste. Genevieve.—A company has been organized to build a brewery, ice factory and electric lighting plant; capital, $30,000.

NEW HAMPSHIRE.

Plainfield.—C. F. Lewin has built a cold storage building at the Pearl place, and has filled it with ice.

NEW JERSEY.

Asbury Park.—There is talking of another ice making plant here.

Bloomfield.—The ice plant on Newark avenue is being put in order, owing to the prospects of a deficiency in the supply of natural ice. It is said it will be operated "under a new system."

Bridgeton.—A number of local capitalists are considering the project of starting an ice plant in that city.

Burlington.—Local capitalists are "talking ice factory."

Elizabeth.—The Elizabeth Ice Co. is putting its plant into operation, owing to the failure of the natural crop.

NEW MEXICO.

Albuquerque.—The Crystal Ice Co. is building additional room for cold storage, and increasing the ice storage to 400 tons capacity.

Eddy.—The Eddy Ice and Electricity Co. have ordered a car load of coils from the Samson Steam Forge Works, Chicago, for that plant, which is nearly completed.

NEW YORK.

Bay Shore, L. I.—Is about to have an artificial ice plant.

Norwich.—The Norwich Storage Co. is erecting a cold storage house, 45×75×100 feet in size, to be completed by April 1. The A. I. Dexter system is used throughout the building, which is of four stories, the first two floors being divided into storage apartments on either side of a central hall. About 10,000 tons of ice are stored on the third floor.

South Hampton.—Is to have an ice factory.

OHIO.

Cincinnati.—The Consumers' Ice and Refrigerating Co., of Cincinnati, capital stock, $100,000, the purpose of which is the manufacture and sale of ice for all purposes, and the conducting of a general refrigerating and abattoir business, was incorporated February 10, by Casper V. T. Hopple, William A. Megrue, A. Bert Meader, William Geringer and Richard B. Hopple. This scheme is said to have originated in a desire on the part of Mr. Hopple to make use of a spring of water, on a lot of his in the bend of Spring Grove avenue, and alongside where the new stock yards were built. The spring is known to have been running for the past seventy years, and runs a steady 4-inch stream. A well has been driven near by on the same lot, which has about the same capacity. There are already some buildings on the lot which may be used. It is considered that there is sufficient water from the two sources to run a 30-ton ice machine, and that will be the capacity of the new plant.

East Liverpool.—A company has been organized to build a $50,000 ice factory.

Massillon.—The Artificial Ice Co. are remodeling their plant, and have put in a new machine manufactured by the Sulzer & Vogt Ice and Refrigerating Co., of Louisville, Ky. In connection with the sale of ice, the company is considering a plan for supplying customers with distilled water for domestic uses, for which it is believed there will be a ready sale in Massillon.

North Amherst.—The North Amherst Cold Storage Co. has been incorporated, capital stock, $10,000, by Parks Foster, E. C. Foster, Frank M. Barber, Jas. Nicoll, Jr., H. N. Steele, E. F. Steele, H. G. Reddington.

Youngstown.—John Smith's Sons, brewers, are putting in another ice machine to make ice for the retail trade.

OKLAHOMA TER.

Guthrie.—Richard Deutsch, of the Pabst Brewing Co., is credited by a local paper with the statement that the ice plant here, of which Henry Linn is manager, will be increased to 50 tons capacity.

North Enid.—The Enid Pure Ice Co. have purchased a car load of coils from the Samson Steam Forge Works, Chicago.

PENNSYLVANIA.

Hazleton.—The Mercantile Co. will build a refrigerating plant. Ice will be manufactured there as soon as the machines can be put in place.

Philadelphia.—A permit has been issued for the erection of a three-story brick and iron cold storage house, twenty-six by fifty feet, on Queen street, north of Pulaski avenue, for William Christy.

Philadelphia.—The Jefferson Ice Co. will put up a $20,000 ice factory, using the Kilbourn system.

Philadelphia.—The Consumers' Ice Mfg. Co., of Philadelphia, has made a contract with Kreiss & Shipp, Reading, Pa., agents for John Featherstone's Sons, Chicago, for a complete 30-ton ice making plant. The machinery will be of the consolidated type, manufactured by John Featherstone's Sons, Chicago. This is a duplicate order, the company having had a consolidated machine in their plant for the last four years.

South Bethlehem.—J. B. Maxwell, A. L. Wickert and Adam Brinker have incorporated the Lehigh Valley Cold Storage Co., capital, $155,000.

Turtle Creek.—A company is being formed for the manufacture of ice. Mr. P. G. Ziskan is the head of it.

RHODE ISLAND.

Providence.—Work on the building for the Providence Cold Storage, Freezing and Warehouse Co. on Kingsley avenue, is being pushed rapidly. The structure has reached a height of three stories and will be completed early in the spring.

SOUTH CAROLINA.

Greenwood.—R. M. Freeman wants circulars of the latest improved ice making machinery.

TENNESSEE.

Nashville.—The new Nashville Ice Co. are remodeling the old "Nashville Ice Factory" to make ice by the plate system.

TEXAS.

Austin.—G. Bean and D. Doppelmeyer, of Marshall, intend to crect an ice and cold storage plant here.

Dallas.—The Crystal Ice Co., of Dallas, is adding to the capacity of its factory, and will put in additional machinery.

Denison.—A $50,000 stock company will be organized at once for the purpose of erecting a 20-ton ice factory to cost $40,000. W. E. Knaur, of Denison, M. B. Pierce, of Madison county, Ill., and A. J. Utiger, of Bend county, Ill., are interested.

Fort Worth.—J. T. Burt & Co. have let contract for a large building which, upon completion, they will equip with a 40-ton ice plant and a plant for the manufacture of ice factory machinery. Work has commenced on the building and on an artesian well.

Fort Worth.—The Anheuser-Busch Brewing Association will set up a 40-ton De La Vergne machine here to cool their beer storage depot and to make ice. It was purchased through the St. Louis office of the De La Vergne company.

Houston.—The American Brewing Association has purchased a 25-ton De La Vergne machine through the St. Louis office of the De La Vergne company. This is an addition to the ice making plant, which will have seventy-five tons ice making capacity besides over 200 tons of refrigerating capacity.

VIRGINIA.

Farmville.—The erection of an ice plant is comtemplated. S. B. McKinney can give information.

Portsmouth.—E. C. Hillyer, of Newport News, is putting up an ice making plant here.

WEST VIRGINIA.

Clarksburg.—The erection of an ice factory is contemplated by Wm. Osborn.

St. Clairsville.—J. H. Close, of Baltimore, has been here several months working up a cold storage plant to be erected here. The prospects are that a company will soon be formed and the work begun.

Wheeling.—The ice machines for Louis Neibergal's butcher shops have been placed in the new building on the corner of Forty-sixth and Eoff streets. The new plant is complete in every respect. The machines were started up early in February.

Wheeling.—The new Arctic and Storage Co., recently organized, has elected Henry Schmulbach president, and Will Shanley, secretary. The company has purchased the old Butterfield malt house, on the corner of Water and Twenty-third streets, paying the sum of $20,000. The company will equip the plant and have it in operation at the opening of the summer season.

WISCONSIN.

Superior.—Barber Bros.' new cold storage building on Banks avenue has been completed.

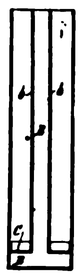
——The newly elected officers of the Ice and Cold Storage Co., of Carthage, Mo., are as follows: President, A. Hausman, of St. Louis; vice-president, M. L. Reid; secretary and treasurer, Dr. A. H. Caffee; attorney, H. H. Harding; superintendent, A. H. Snyder.

We append below the most important new patents relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for ICE AND REFRIGERATION.

FREEZING CAN FOR ICE MACHINES.

No. 511,120. Elbridge Butler, Conshohocken, Pa. Filed August 4, 1893. Serial No. 482,384. Patented December 19, 1893. (No model.)

Claim.—A freezing can provided with a central air chamber extending vertically across the can and separating its water space into two ice chambers having their outer sides exposed to the action of the refrigerant substantially as and for the purpose set forth.

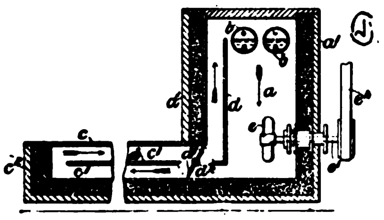


2. A freezing can provided with a central air chamber extending vertically across the can and over its bottom surface, thereby separating the water space of the can into two ice chambers having their outer sides exposed to the action of the refrigerant, substantially as and for the purpose set forth.

REFRIGERATING APPARATUS.

No. 511,239. Frederick B. Hill, London, England, assignor to the Hills Cold Storage Co., Limited, same place. Filed June 9, 1892. Serial No. 436,164. Patented December 19, 1893. (No model.) Patented in England December 27, 1889, No. 20,811.

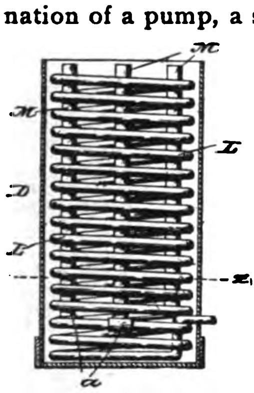
Claim.—1. The combination in an apparatus for rapidly cooling chocolate and other substances, of a heat conducting plate *c*, a chamber *c'* beneath the said plate, a tank *a* for containing a non-congealable liquid and communicating with the said chamber, refrigerating tubes *b* connected with an apparatus for the production of cold and arranged within the said tank above the level of the said heat-conducting plate, whereby the said liquid is cooled and its circulation beneath the said plate effected by gravity without the use of a pump, substantially as hereinbefore described.



REFRIGERATING APPARATUS.

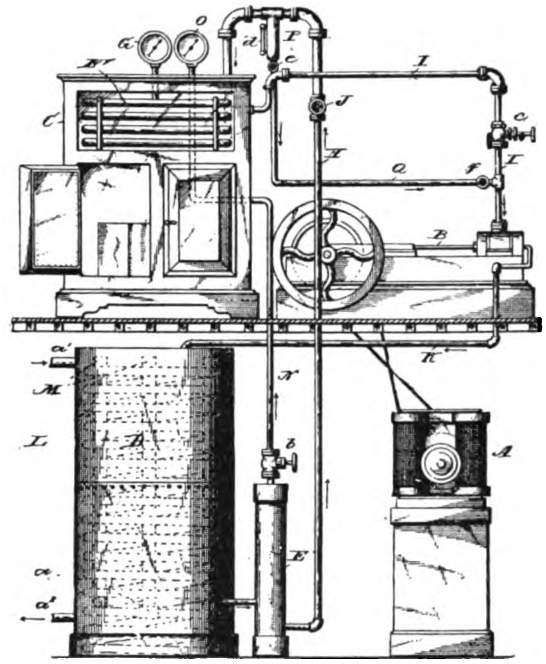
No. 511,857. William Mild, Hamilton, Ohio. Filed December 31, 1892. Serial No. 456,901. Patented January 2, 1894. (No model.)

Claim.—1. In a refrigerating apparatus, the combination of a pump, a source of liquid ammonia supply, a refrigerating coil, a pipe connecting said coil and supply source, an expansion valve located in said pipe, an expansion chamber between said valve and coil, a trap for said expansion chamber and connections between said trap and pump, substantially as described.



2. In a refrigerating apparatus, the combination of a pump, a source of liquid ammonia supply, a refrigerating coil, a pipe connecting said coil and supply source, an expansion valve in said pipe, an expansion chamber, between said valve and coil, a trap connecting with said expansion chamber, a pipe connecting said trap and pump, and means for controlling the flow of ammonia to said pump, substantially as described.

3. In a refrigerating apparatus, the combination with the liquid ammonia supply tank, a condensing tank, a condensing coil within said latter tank and connected

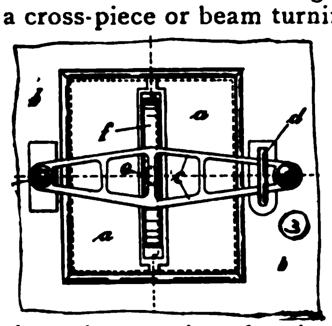


with the supply tank at a point above the bottom of said supply tank, of a series of vertical condensing pipes rising from said condensing coil at a point near its bottom.

FASTENING FOR THE COVERS OF ICE CISTERNS.

No. 511,475. Alexander M. Tippner, Dresden, Germany. Filed February 20, 1893. Serial No. 462,978. Patented December 26, 1893. (No model.) Patented in Germany, June 2, 1892.

Claim.—1. In fastenings for covers of ice receptacles, a cross-piece or beam turning on a fixed bolt as a pivot, a rail adapted to be compressed thereby. a spring upholding said rail, and a cramp adapted to catch and hold down the beam upon said rail, when the beam is extended over the cover, substantially as described.

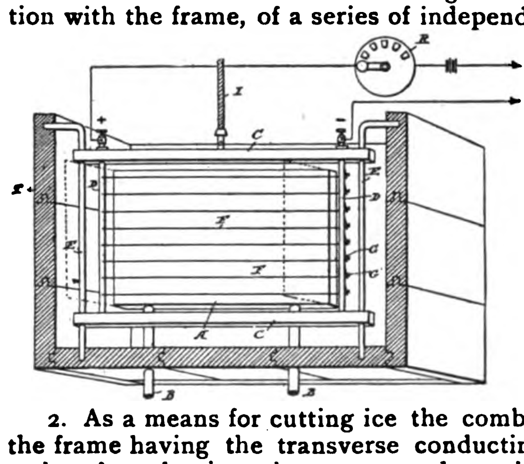


2. The combination in ice receptacles, of the top *b*, cover *a* adapted to fit therein and close the opening therein, arm *c* pivoted on said top, cramp *d* fixed on said top *b* and adapted to receive said arm *c* when in one position, spring *e* fixed on said cover, and supporting the course *f* which is adapted to press upward against said pivoted arm *c* and thereby hold the cover *a* tightly in place, substantially as described.

MEANS FOR CUTTING ICE.

No. 508,819. Leo Daft, Seattle, Wash. Filed May 2, 1892. Serial No. 431,503. Patented November 14. (No model.)

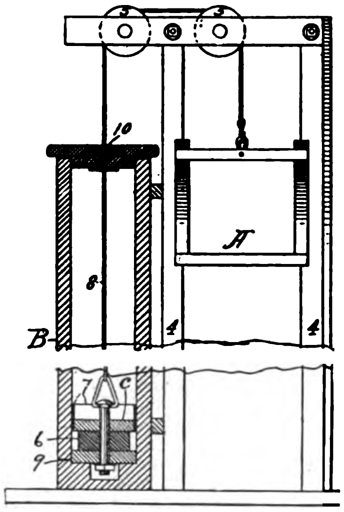
Claim.—1. As a means for cutting ice the combination with the frame, of a series of independent conducting wires, devices for regulating the tension of each wire, and connections between all the wires and a source of electric energy, substantially as described.



2. As a means for cutting ice the combination with the frame having the transverse conducting bars, of a series of conducting wires connected to said conducting bars, tension devices mounted on one of the bars, and connected to the wire and connections between the conducting wires, and a source of electric energy.

ICE LOWERING APPARATUS.

No. 506,777. Charles I. Foster, Meriden, Conn., assignor of one-half to George A. Foster, same place. Filed May 18, 1893. Serial No. 474,643. Patented October 17, 1893. (No model.)

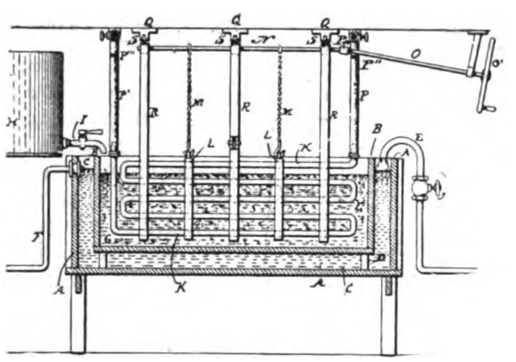


Claim.—1. The herein described apparatus for lowering ice, consisting of the vertically moving carriage mounted on a suitable frame, the air cylinder or box in connection therewith, the valved piston fitted practically air tight within said cylinder, and the cord or cable connecting said piston and carriage, all combined for forming an air cushion within the cylinder to check the movement of the piston when the carriage descends, and to permit said piston and carriage to move in the opposite direction, without forming any cushion in the cylinder, substantially as described and for the purpose specified.

LARD COOLER.

No. 512,642. Walter L. Whitman, Bridgeport, Pa. Filed January 14, 1893. Serial No. 458,429. Patented January 9, 1894. (No model.)

Claim.—1. A temperature regulator for liquids, comprising in its construction a tank, a coil or connected

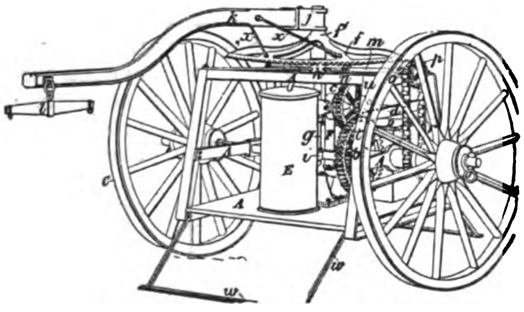


series of pipe, a vertically movable support for said pipe, flexible connectionss from said coil or series to supply and discharge pipes, means for raising and lowering said support, and independent means for vibrating said coil or series of pipe or support relatively to the tank, for the purpose set forth.

REFRIGERATING AND ICE MAKING MACHINE.

No. 507,004. Frederick B. Hill, London, England, assignor to the Hills Cold Storage Co., Limited, same place. Filed June 9, 1892. Serial No. 436,161. Patented October 17, 1893. (No model.) Patented in England November 23, 1888, No. 17,071.

Claim.—3. The combination, with the traveling wheel *C* and the driving shaft *d* the refrigerating or ice making mechanism, of the sleeve *a* on which the said wheel *C* is fixed, a toothed wheel *b* fixed on the said sleeve and geared with a toothed



wheel *c* on the said driving shaft *d*, a crown wheel *f* adapted to receive a pole for rotating it, a bevel wheel *o* geared with the said crown wheel, a sleeve *s* fitted to rotate on the sleeve *a*, an endless chain *r* connecting the bevel wheel *o* with the sleeve *s*, a toothed wheel *t* fixed upon this sleeve and a toothed wheel *u* on the shaft *d* adapted to gear with the wheel *t*, the wheels *c* and *u* being movable longitudinally on the shaft *d* to bring one or the other of them into gear with the wheels *b* and *t* respectively.

TRADE NOTES.

——Mason City, Iowa, housed 10,000 tons.

——Dealers at Great Falls, Mont., housed 10,000 tons.

——Wisconsin cut, all told, probably 2,000,000 tons this season.

——The Pawtucket (R. I.) Ice Co. has housed about 12,000 tons.

——Baltimore county, Maryland, had ice four inches thick this year.

——Elkhart lake, Sheboygan, Wis., housed 12,000 tons for Chicago firms.

——A. T. Cornish and R. W. Bell cut 7,000 tons at Bellemont, Arizona Territory.

——The Laramie (Wyo.) Coal and Ice Co. sent 4,000 tons to Denver in January.

——On February 21 the Boley Ice Co., Pekin, Ill., was harvesting 8½-inch ice.

——Swift & Co. cut over 75,000 tons at Ashland, Neb., with 300 men, in twelve days.

——Hueppchen & Ott have sold their ice house at Plymouth, Wis., to Herman Pieck.

——The Chicago Knickerbocker Ice Co.'s houses at Oconomowoc hold 60,000 tons.

——Chas. A. Sisson is building a 3,000-ton house at Turner's pond, New Bedford, Mass.

——The Holyoke and South Hadley Falls Ice Co., Springfield, Mass., harvested 15,000 tons.

——Madison, Wis., will close the season with 150,000 tons in store, besides the amount shipped south.

——F. W. Doloff has purchased the ice business of S. G. Scott at Newport, Vt.; consideration, $1,000.

——Wisconsin ice has been selling at $2.60 per ton on the tracks at St. Louis during most of the ice cutting season.

——The Auburn (R. I.) houses were empty on February 13, all the local companies having gone to Massachusetts for their supplies.

——Carl Lang has purchased, through the St. Louis agency, a 50-ton De La Vergne refrigerating machine for his brewery at Huntingdon, Ind.

——Alfred White, brewer, Ottawa, Ill., has made a contract with the Hercules Ice Machine Co., Aurora, for the erection of a 10-ton refrigerating machine in his brewery.

——The John Hauk Brewing Co., Brighton Station, Ohio, is putting in a new Frick refrigerating machine, for which work the Samson Steam Forge Co. has furnished a car load of coils.

——The John L. Ebner Brewing Co. is having extensive repairs made by Westerlin & Campbell, Chicago, for which work the Samson Steam Forge Works has furnished a car load of coils.

——Stohr & Melson, Hannibal, Mo., have purchased the ice machine lately used by Herl & Rendlen, brewers, which will be removed to the purchasers' packing house and used for refrigerating the stores.

WANTED AND FOR SALE ADVERTISEMENTS.

[*The charge for advertisements in this column is $2 each insertion for seventy words or less, and twenty-five cents for each additional fourteen words. No advertisements will be inserted unless accompanied by the necessary cash. Parties answering these advertisements must write to the addresses given, as the Publishers decline to furnish any information concerning them.*]

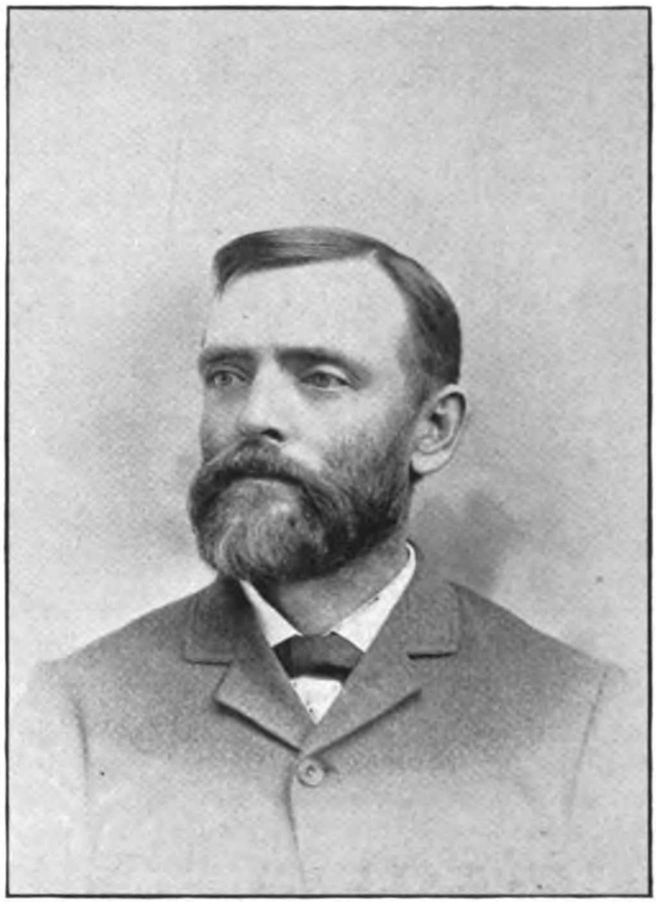
VOL. VI. NO. 4. CHICAGO : NEW YORK : APRIL : 1894. $2.00 PER ANNUM

[Special Report to ICE AND REFRIGERATION.]

FLORIDA ICE MANUFACTURERS' ASS'N.

PROCEEDINGS OF THE REGULAR ANNUAL MEETING—IMPORTANT RESOLUTIONS ADOPTED—OFFICERS ELECTED FOR THE ENSUING YEAR—THE AMMONIA QUESTION.

THE annual meeting of the Florida Ice Manufacturers' Association was called to order by the president, Mr. E. W. Codington, at the Sanford House, Sanford, March 14, at 2 P. M. The following factories were represented: Crystal Ice Works, of Barton, by E. W. Codington; Ybor City Ice Works, Ybor City, by A. C. Moore; Tampa Bay Ice Co., of St. Petersburg, and Sanford Ice Co., of Sanford, by Messrs. Lake & Dudney; Orlando Ice Manufg. Co., Orlando, Robt. Howe; Indian River Ice Manufg. Co, Titusville, Messrs. Wetmore & Gladwin; Leesburg Ice Co., Leesburg, J. C. Lunning; East Florida Ice Manufg. Co., Ocala, Simon Benjamin; Arctic Ice Co. and Refrigerator Ice Works, Jacksonville, W. S. Ware; Palatka Ice Factory, Palatka, L.C. Canova; also Mr. Guy R. Pride, of the Hygienic Ice Works, Jacksonville, and Mr. Robert Gamble, of Tallahassee, both new members who were admitted to membership at this meeting. Mr. H. D. Stratton, formerly of the Columbus Iron Works, was present by invitation.



E. W. CODINGTON, BARTOW.
President Florida Ice Manufacturers' Association.

The minutes of the previous meeting were read and approved.

Application for membership from Robt. Gamble, for his factory now being erected at Tallahassee, and Guy R. Pride, of the Hygienic Ice Works, of Jacksonville, were presented by the secretary, and both factories were admitted.

The arbitration committee had no report to make.

The committee on ammonia reported the advance in the price of ammonia, and a general discussion followed. The Association then adopted the following resolution:

That the secretary issue a circular letter to the various ammonia companies, and requesting bids for supplying both aqua and anhydrous ammonia for the many plants under the jurisdiction of the Association for the season of 1894, the ammonia company to give sufficient guarantee as to quality. The right to reject any and all bids reserved. Bids to be in by April 5th. Further,

Resolved, That as soon as bids are received the secretary will notify and meet the ammonia committee and they shall decide what to do with the bids in the interest of the Association—the recommendations of this committee to be binding on all members—and all contracts are to be made through the secretary between the ammonia company and each individual ice plant.

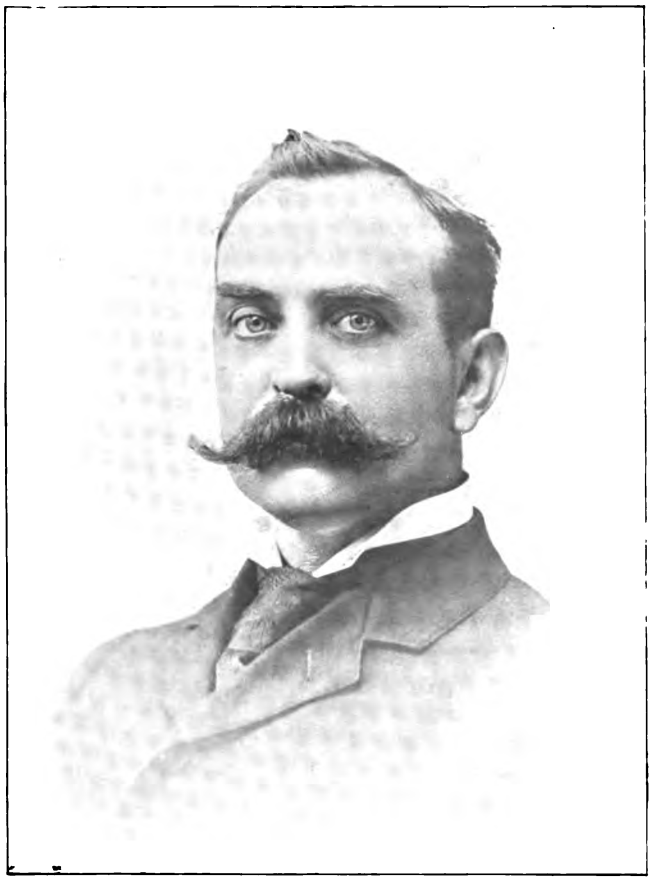
The secretary was instructed to put a notice in the January, 1895, number of ICE AND REFRIGERATION, calling for bids for ammonia for the season of 1895, and to present the bids at the next annual meeting.

The special committee appointed at the last meeting to visit Gainesville made their report, showing that the Gainesville plant was doing everything possible to encourage the raising of fruits and vegetables for shipment in refrigerator cars; further, that the prices charged were not exorbitant, as represented. The president addressed the meeting as to the quality of iron put into coils by the

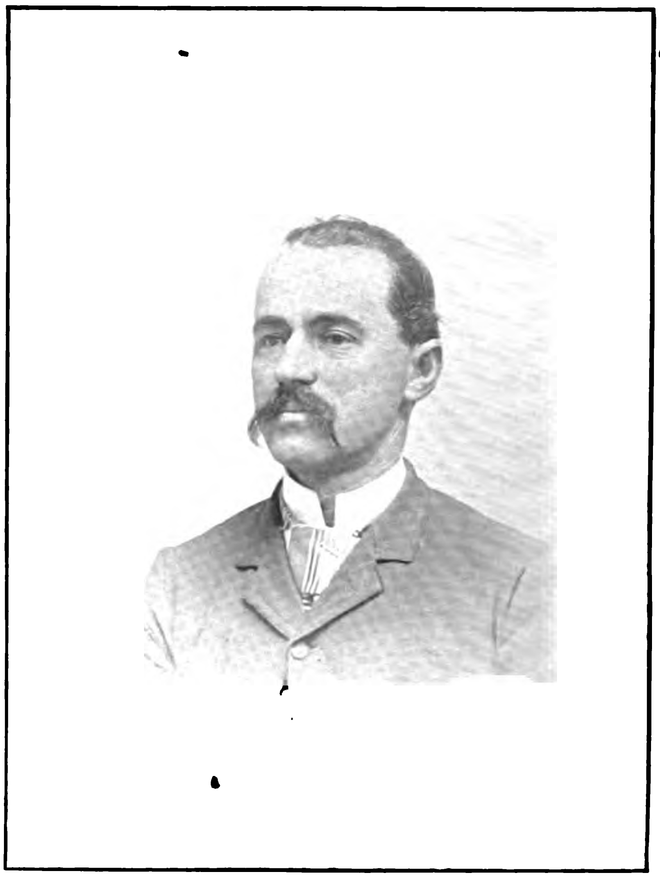
manufacturers. Under similar circumstances and conditions, some coils, he said, had lasted several years, while others had lasted but a year, showing a great difference in the iron; and he suggested that an analysis be made of the two different irons, so that in the future in ordering coils the purchaser could specify the kind of iron he wanted. The president was authorized to have said analyses made.

Letters were read from R. M. Freeman relative to forming a Mutual Association for the Southern states. The secretary was instructed to inform him that a representative would be at the Southern Ice Exchange meeting, and he could there learn more of his project.

The following officers of the Association were elected: E. W. Codington, president (re-elected); Guy R. Pride, vice-president; L. C. Canova, secretary and treasurer (re-elected); Robert Gamble and Simon Benjamin additional members of the arbitration board.



GUY R. PRIDE, JACKSONVILLE.
Vice-President Florida Ice Manufacturers' Association.



L. C. CANOVA, PALATKA.
Secretary and Treasurer Florida Ice Manufacturers' Association.

The president appointed the following ammonia committee: W. S. Ware and Guy R. Pride.

On motion of Mr. Ware, Mr. Benjamin was appointed to represent the Association at the meeting of the Southern Ice Exchange at Atlanta, Ga. It was the general impression of the members that the annual meeting should be held earlier in the year, and on motion of Mr. Lake the time was changed to the second Wednesday in February.

Jacksonville was chosen as the place for holding the next annual meeting.

At the suggestion of Mr. Ware, the Southern Ice Exchange was cordially invited to hold the annual meeting for 1895 at Jacksonville, on the second Wednesday of February, and after the adjournment of the respective associations the members could meet jointly and have a general conference.

The secretary was instructed to forward the resolutions adopted to the Southern Ice Exchange, and urge acceptance of same.

A vote of thanks was tendered Messrs. Lake and Dudney for their many courtesies to the members.

The president, in closing the meeting, paid a high tribute to ICE AND REFRIGERATION, and his words were but an expression of the views of the members present, and were indorsed by them in the following resolution:

We find ICE AND REFRIGERATION an able journal in the interest of ice manufacturers; it is an invaluable source of information nowhere else obtainable, as it is furnished with articles from able writers, and the interchange of ideas in its columns from practical men is of immense importance to each manufacturer and ice association; further, it is a journal that is read with pleasure as well as profit, and we heartily indorse and recommend it.

On motion, adjourned. L. C. CANOVA, *Sec'y.*

Mr. Guy R. Pride, vice-president of the association, is a native of New York state, having been born in Honeoye Falls in 1856. His childhood and early manhood were passed in that town. His first business position was with his father in a hardware store. He afterward engaged in the milling business (wholesale flour) under the firm name of Smith & Pride. In 1874 Mr. Pride made his first visit to Florida, becoming the owner of an orange grove. He was a yearly visitor to the state until 1888, since which time he has been a permanent resident of Jacksonville. In 1892 he erected his present factory (the Hygienic Ice Works) which is in successful operation. During the past winter he has added to it a fine cold storage room.

[*Written for* ICE AND REFRIGERATION.]

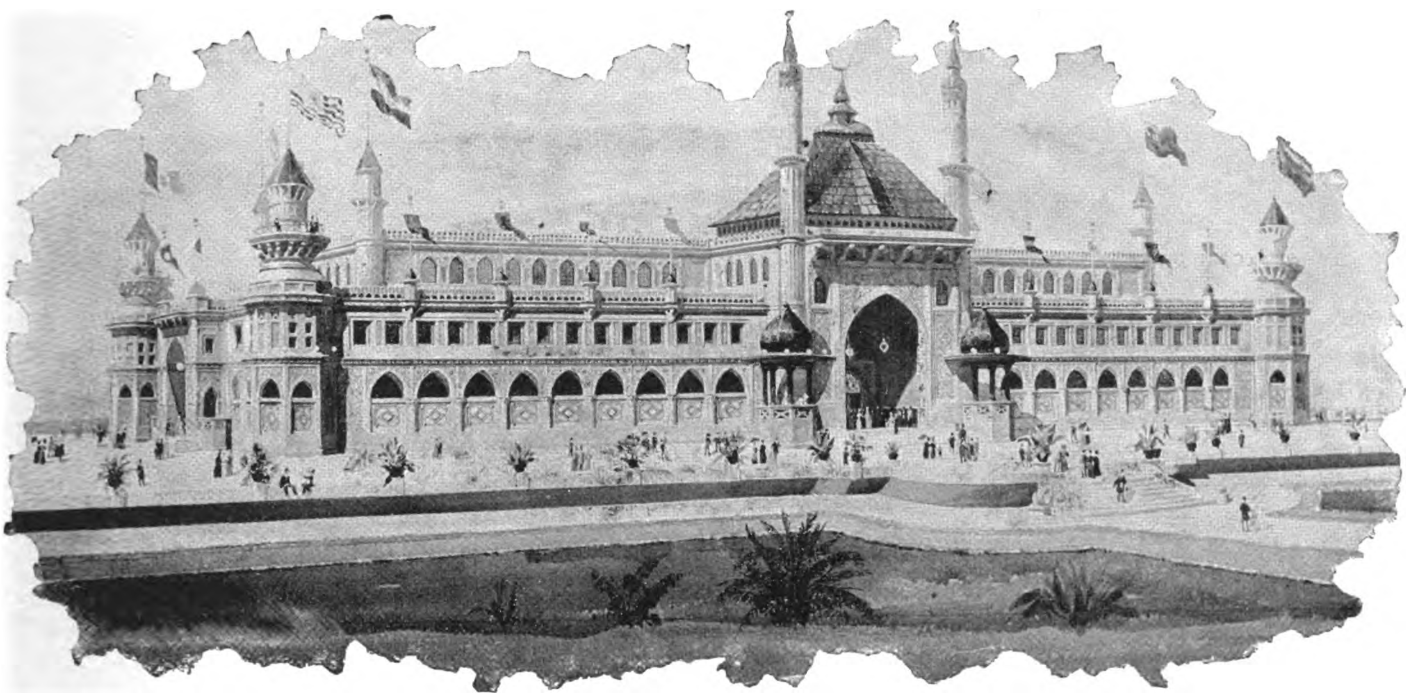
THE CALIFORNIA MIDWINTER EXPOSITION.

THE GREAT EXPOSITION OF THE PACIFIC COAST—A MATERIAL AND ARTISTIC TRIUMPH—SKETCH OF THE BUILDINGS—AN ICE SKATING RINK, AND HOW BUILT.

CALIFORNIA'S unique Midwinter Fair has been one gigantic surprise from its very inception. It is an achievement which has grown with such wonderful rapidity that even to Americans it is looked upon as marvelous. With its scores of gaily tinted buildings, its great electric tower, its brilliant Grand Court, its great Firth wheel, its 'Forty-nine street, its "Midway" and its superb display of tropical gardens, all the work of seven short months,—it cannot but excite wonder and at the same time call forth general pride that it is an American institution.

If the historic achievements of Chicago were not fresh in the minds of the people, even greater would be the wonder expressed at this later triumph on the Pacific coast, for the Midwinter Fair is international in its scope and much larger and more beautiful and complete than any of the international exhibitions that have been held in the past, those of Chicago and Paris (1889) alone excepted. Yet where years were consumed in the preparation of the others, San Francisco required only months.

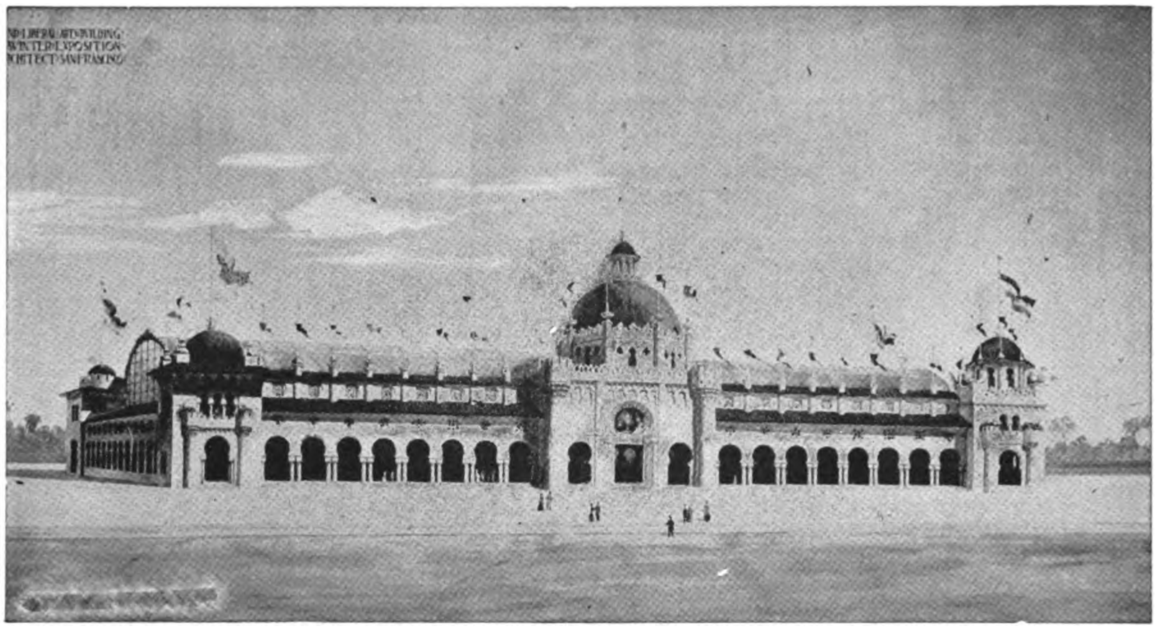
The buildings, main and small, are strikingly ornate. In Chicago there was a preponderance of white; in San Francisco there is a bewildering kaleidoscope of colors. One writer has termed it the "City of Opals"—a very fitting name. Entering the Grand Court at the east, the first great building to attract the eye is the Manufactures and Liberal Arts. Its towering blue dome and golden lantern are set against the sky like some immense jewel glistening in the sunlight. The grayish-green tiles of the roof give a subtle suggestion of age, while the structure itself is colored in ivory. Throwing it into relief are strong reds, yellows and light blues. The tone grows warmer as it nears the ground and comes into direct contrast with the foliage. There is a long array of columns and arches forming an arcade in the front of the building, and above the arcade is a series of windows which take the form of many of those found in the old California missions. The main building is 462x225 feet, and the annex of 370x60 feet gives an aggregate area of 130,000 square feet. At the southern side of the Grand Court a great East Indian structure is erected whose towers and minarets glisten like gold in the sunlight, while the star and crescent gleam high above the central spires. This is the building of Mechanic Arts, the second in size of the exposition structures, 330 feet long by 160 feet wide. At the northern end of the Grand Court is the Horticulture building, a long, low building with a wide glass covered dome, reminding one forcibly of the old missions; a structure 400 feet long and at its widest part 190 feet. Between the Horticultural and Manufactures building is a great structure for Fine Arts, simple in form and unpretentious in outline, presenting an adaptation of Egyptian architecture for the use of a modern exposition. Towering above all the other structures of the exposition, glistening with its wealth of golden ornament, delicate and airy in its delicate columns and arches, with bannerets giving color and life, is the Administration building. It, too, is oriental in outline and in its detail of ornamentation. The local tone is old ivory, but the great dome and the four towers are gilded, while reds and yellows play an important part in carrying out the idea of the oriental. In architecture it is a combination of Central Indian and Siamese. The leading feature of the building is a richly ornamented dome 135 feet high and fifty feet in diameter. In the center of the Grand Court is the electric tower, a graceful, airy structure of steel, colored in rich bronze, rising to a height of 260 feet. Like the Eiffel tower at Paris and the Ferris wheel at Chicago, it is the leading point of interest. Its top is crowned by the largest search light in the world, while the outlines of the tower itself are literally covered with thousands of lights formed in fantastic shapes. The tower at night can be seen for miles.



CALIFORNIA MIDWINTER FAIR—MECHANICS' ART BUILDING.

The Midwinter Fair has all the Midway Plaisance features of the great White City, but they have not been centralized as at Chicago. The Firth wheel, situated

on a knoll in the north end of the grounds, one of the triumphs of the exposition, although not quite so large, is modeled after the Ferris wheel in every respect. But perhaps the most interesting of all the concessions is the 'Forty-nine mining camp, which represents the main street in a typical mining camp in California, when mining was the only California industry. The music and



CALIFORNIA MIDWINTER FAIR—MANUFACTURES AND LIBERAL ARTS BUILDING.

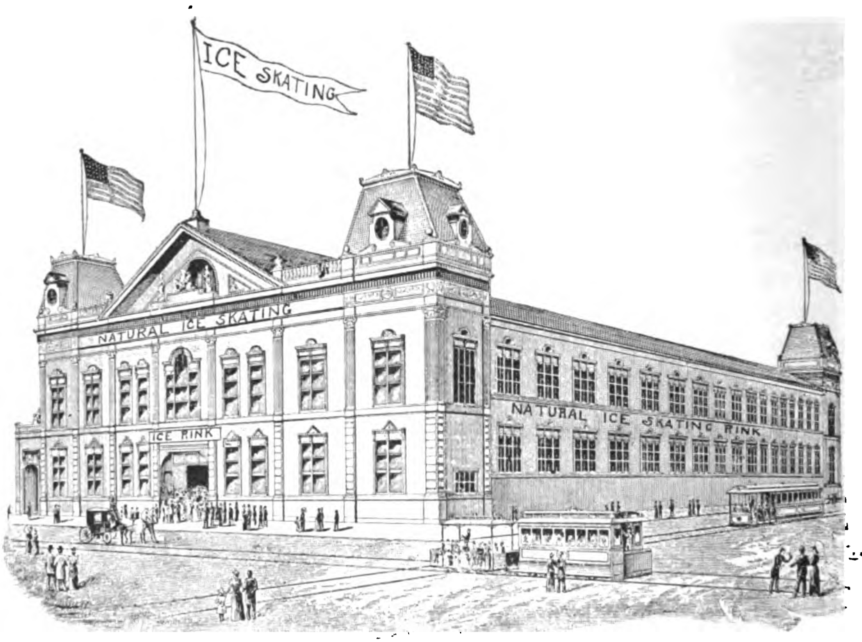
dancing halls are there; the faro bank is in full operation; and on the boards of an old-time theater the variety actors and actresses hold sway. All the old-time incidents are enacted there daily for the pleasure of the visitors. A small stream representing a mining gulch runs through one corner of the street, and here daily the miners can be seen washing out supposed gold with their pans and rockers. An old stage coach, used in the days of '49, makes hourly runs from the Administration building to the village, and once every hour a regulation lynching bee is held in the main square. Off in another part of the grounds is a Moorish building, called the hunting hall, adjoining which are the Streets of Paris, another interesting sight. There are still many other concessions, such as Moorish restaurants, a Flemish dairy, an American restaurant, a chocolate palace and nearly 100 oriental kiosks.

The Midwinter Fair buildings cost in the neighborhood of $2,500,000; cover 160 acres of ground. Up to March 25 the attendance has been nearly 1,000,000, a considerable number for an exposition located in so remote a section of the country. The tide of travel now is, in fact, distinctly coast-ward, and all the lines are vying with each other to offer the greatest attractions to travelers. To those of our readers who are going to the coast, and go *via* the southern route, we can commend knowingly the M., K. & T. route as touching some of the most interesting parts of the new Southwest. The North-Western railway further north presents unequaled accommodations and fast time, were one in haste; while still farther north the Northern Pacific offers fine accommodations and magnificent scenery.

THE NATURAL ICE SKATING RINK.

Though the Natural Ice Skating Rink is in fact no part of the "Midwinter Fair," yet its construction being synchronous with that of the Fair, one naturally thinks of it as a part of the former. At any rate, the two are so intimately associated in many minds that any notice of the one, in this journal at least, would be incomplete without noticing also the other.

The rink is built in "Mechanics' Pavilion," in the heart of the city, by the National Ice Skating Co.; and although it has been opened only a few weeks, "skating on real ice," as the *Call* says, "is rapidly becoming one of the most popular indoor amusements in San Francisco. To native sons and daughters who have never experienced the rigors of an eastern winter, it is a thrilling novelty. To those who have enjoyed the exhilarating

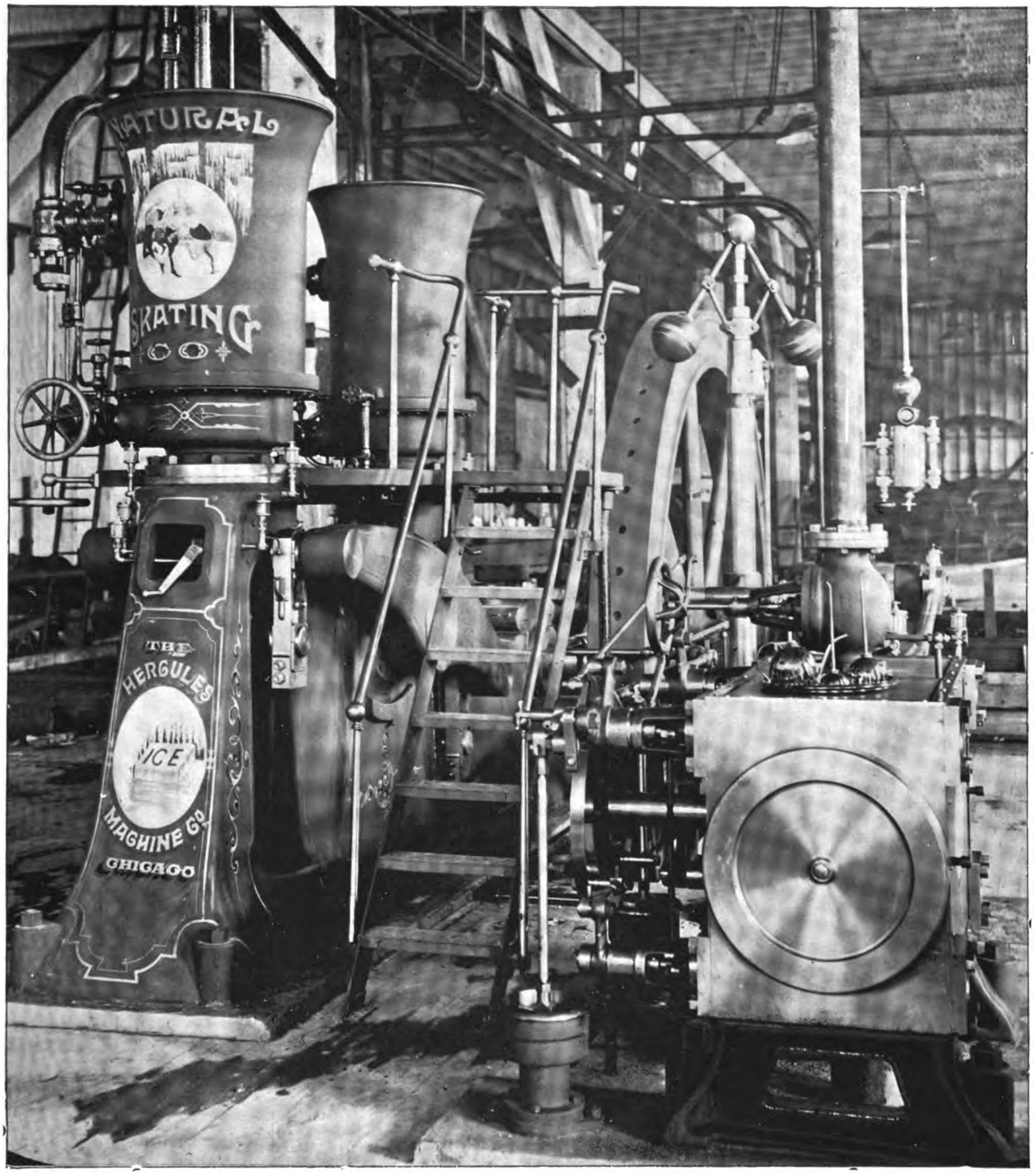


NATURAL ICE SKATING RINK.

sport in a land of blizzards and frosts, it is made more enjoyable by the fact that winter dress is unnecessary." "This idea of a big skating rink with natural ice," said W. N. Donaldson, general manager, to the *Call*, "is not exactly a new one in this country. Right here in San Francisco it has been tried three times, but each

attempt failed because the organizers did not master the intricate mechanical appliances. This is the first natural ice skating rink operated in the United States [with the exception of the very successful one operated for months at Madison Square Garden, New York City, in 1879, by Thos. L. Rankin.—ED.], and the fourth [fifth] in the world. There is one in Paris, another in Berlin, and a third in Southampton, England."

chine to freezing, and have not yet had to stop. I believe that there was no machine, either refrigerating or ice making, ever put up in that short time. Mr. Goodmanson was the erecting engineer, representing the Hercules Ice Machine Co. He superintended the erection of the machine, and has certainly made an enviable record for the company he represents. I pushed everybody fifteen hours a day, and have succeeded in establishing an ice



NATURAL ICE SKATING CO., SAN FRANCISCO—VIEW OF 60-TON HERCULES MACHINE FREEZING THE SKATING SURFACE.

Writing to ICE AND REFRIGERATION, Mr. Donaldson says: "The machinery (a 60-ton Hercules refrigerating machine, built by the Hercules Ice Machine Co., Aurora, Ill.) arrived in San Francisco January 13, 14 and 16 last. We took the building we occupy on the 15th of the month. On the 23d of January we started our ma-

rink which is certainly mechanically perfect, and highly satisfactory to every one connected with it.

"Our frozen surface is 60 feet wide by 160 feet long [about 10,000 square feet], and is built up of air spaces covered with sheet lead to make it water tight. Upon this floor we laid inch pipes at three-inch centers. We

W. N. DONALDSON.

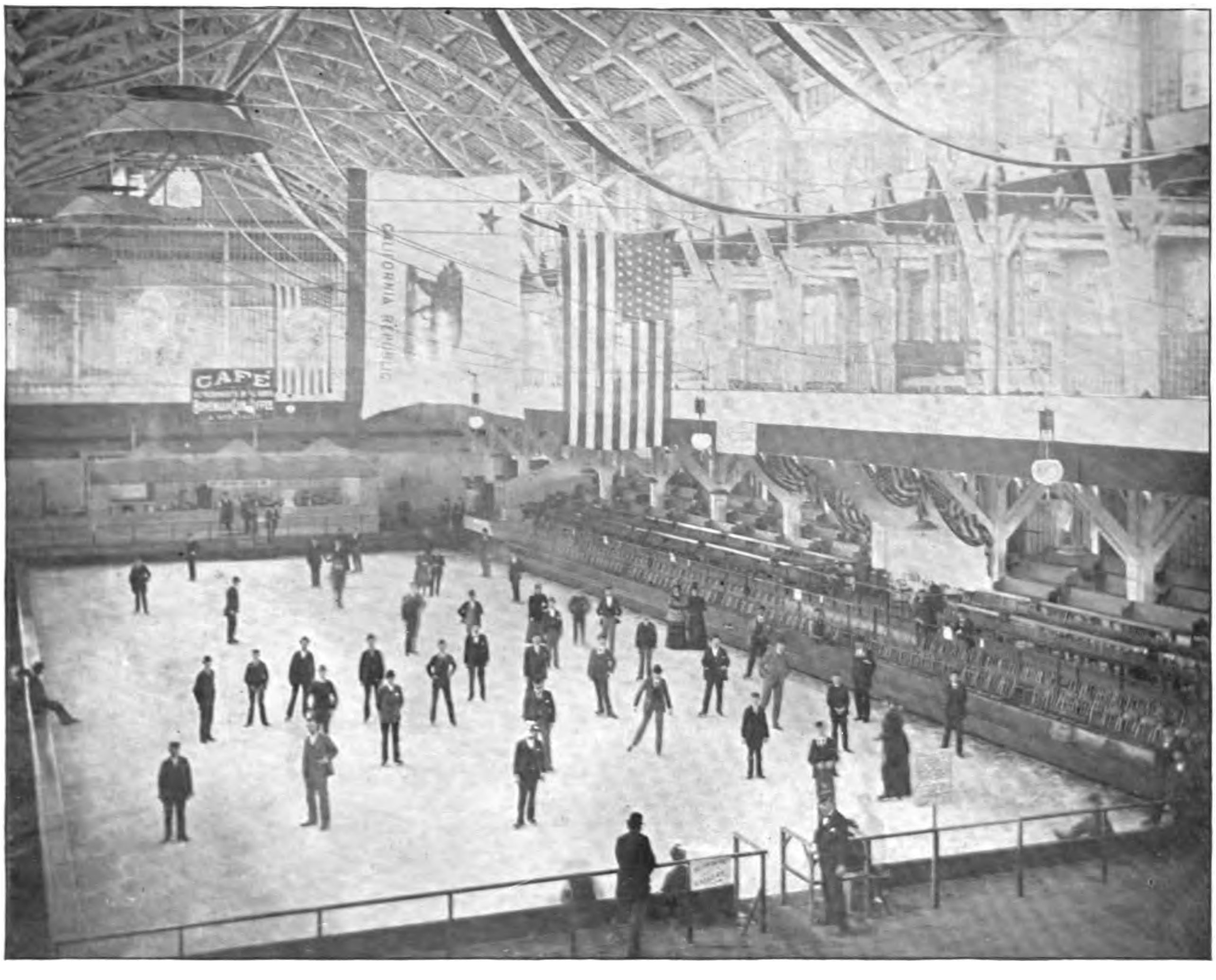
feed the brine from either end and return through a wooden trough, also from either end; this affords an even temperature all over the entire surface. We have four and one-half inches of ice, and reproduce a new surface thereon three times daily by means of a patent sprinkler which I have invented since here. We find no trouble in renewing the surface in thirty minutes' time. We do not carry our brine below 10°, and have nothing in the way of expansion or contraction of the pipes or ice to contend with. Notwithstanding the fact that many old heads belittled the scheme, claiming that it was impossible to make the ice as I proposed to do it, we have done it and it is done well. Upon this small surface of ice we have already seen 811 grown people skating at one time."

The daily patronage since the opening has been profitable, making the venture an entire success.

Our illustrations herewith show the interior and other views of this unique installation of refrigerating machinery, and also the "counterfeit presentment" of the manager, a face many readers will remember as a former employe of the Hercules Iron Works.

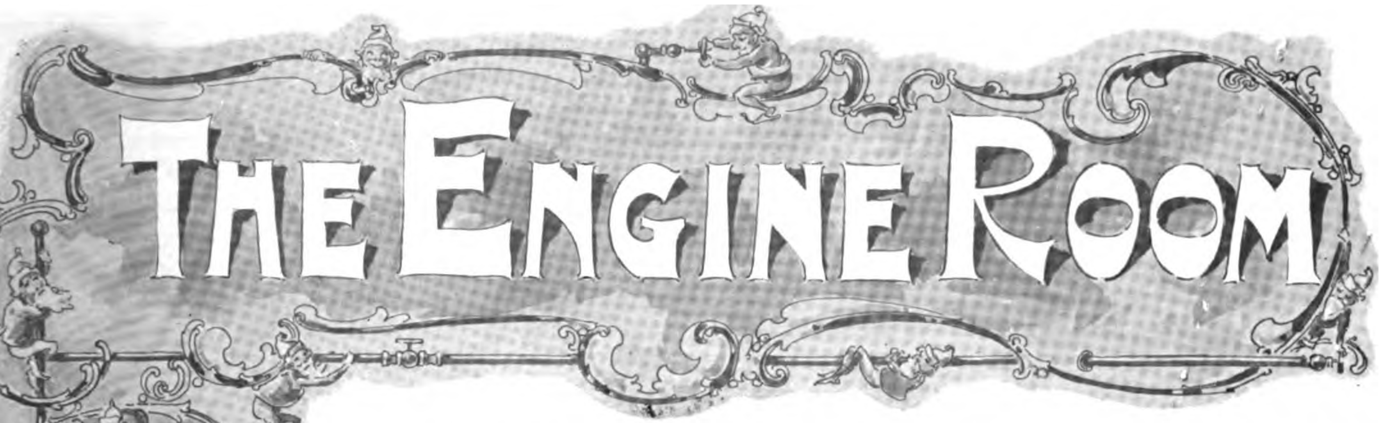
THE refrigerator car companies from Florida have begun carrying vegetables and small fruits to the northern markets, and beginning Feb'y 20, for an extra charge of 10 cents per package, insured the arrival of truck at destination in the same condition as when put aboard the cars there. C. S. Durling, of New York city, is the father of the business in Florida, being the first man to run iced cars for the transportation of fruits and vegetables to New York. Before he began to do so berries could only be shipped by express, and only then when the weather was cool and the berries sour.

IN the article in the March issue of ICE AND REFRIGERATION entitled "Tight Joints," page 183, the last sentence (page 184) reads, "I am pleased to learn that these new joints are *more expensive* than others used for like purposes," etc. It need hardly be said that the word "not" was omitted before the words "more expensive"—the "new joints are *not more expensive*," etc.



NATURAL ICE SKATING CO.—INTERIOR VIEW OF SKATING PAVILION, SAN FRANCISCO.

M. RICHE, at the request of the French government, has recently made a study of the microbes to be found in ice. It was found that ice which to the eye is perfectly transparent, and apparently free from any sort of impurity, may contain more than seven times the amount of organic matter which is allowable in water for drinking purposes. One specimen of ice was found to contain 175,000 colonies of germs for each cubic centimeter (¼ dram). This specimen contained more than forty times the amount of organic matter allowable.



[*Written for* ICE AND REFRIGERATION.]

COOLING AND RE-USING CONDENSER WATER.

SOME METHODS EMPLOYED FOR THIS PURPOSE—CONSTRUCTION AND UTILITY—APPROXIMATE COST—COST OF OPERATING—TEMPERATURES OBTAINED.

BY CHARLES DESMOND.

IN all refrigerating and ice making plants an important factor is the water for condensing purposes. Quantity and temperature, where water must be paid for, are always questions of interest, because the expense bears a close relation to the cost of fuel. In many plants it is quite difficult to obtain the required amount of water at a sufficiently low temperature to materially decrease the cost of operating the plant. Even where water is abundant and costs but little, if the temperature could be reduced by simple and comparatively inexpensive means, it would not only reduce the cost of operation but would practically increase the capacity of the plant.

Where difficulties are experienced in the way of obtaining water for condensing purposes, a common practice is to put down an artesian well, expecting thereby to obtain an abundant supply, the temperature of which will be a few degrees below the average of water obtained from the surface. These wells often give a good supply, but sometimes they do not pay for the cost of producing and many times two or more wells are found necessary. There is always an uncertainty as to what can be obtained from the artesian well and after it is established it is frequently found expensive to maintain. Any method or device, not too expensive to establish and maintain, for cooling the water below its natural temperature or for cooling the water already used for supplying the condenser so that it would again serve the same purpose, would, I think, be readily accepted by the management of numerous refrigerating and ice making plants throughout the country.

The word "numerous" in the above paragraph may be objected to by some as being misleading, by conveying the idea that there are a great many refrigerating plants now established. Considering their number in comparison with other industries, the plants already established may be considered quite numerous, but that number is comparatively as nothing to what it will be five years hence; for when the principles and applications of artificial refrigeration become still more widely known and its capabilities are better understood, both large and small refrigerating and ice making plants will be greatly increased in number.

Using the same water continually and reducing the temperature so that it continues to serve the purpose, has been successfully accomplished for the condensation of steam in plants where the engines are worked condensing, and the operation has been found more satisfactory and less expensive than any other means at command in the particular localities referred to, and under the conditions, even though the cost of water was no greater than usual where it must be purchased.

One plan in use at several plants of which I have knowledge is to maintain a large pond, or reservoir, into which the hot water from the condenser flows, after having passed in a thin stream about one inch in depth over riffles, in a trough or sluice way, and traveling while thus exposed to the air a distance of about 100 feet, finally falling six feet into the pond. The supply, in barrels per horse power, could not be estimated at either of the plants visited, but it appeared to be considerable. The cost of such reservoir is a large item in the first cost of the plant, but is justified by and proves a source of economy through the results obtained. Other means have been tried for obtaining similar results and often have paid well for the expense involved. For condensing steam, the water can be handled at a higher temperature than if required for the condensation of ammonia. For steam condensation, temperatures of 130° and 90° are found practicable, but would be wholly unsuited for purposes of refrigeration.

In ammonia condensation, the open air condenser where the circulation of air is utilized shows an average economy of 50 per cent in the use of water over that of the submerged condenser, the same amount of condensing surface per ton being used. This great saving being due to the vaporization of a portion of the water by the circulation of the air, indicates that the method can be carried still farther, and greater economy obtained. This can be brought about in several ways—either by the use of larger condensing surfaces, the forced circulation of air applied to the condenser, or by exposing the condensing water under suitable conditions to a strong current of air.

Some data have been given regarding a very efficient device for cooling the condensing water used for steam condensation in plants in Germany. There appears no

good reason why the same device should not prove suitable for cooling the condensing water for ammonia refrigeration, as its simplicity, small first cost and expense of operation would make it very desirable for such purpose in many plants where the temperature or cost of water was an object; in fact, it seems that it would be less expensive while being more satisfactory, as the water can be made cooler and be obtained at less expense than from a driven or artesian well or from other supply. This device, as finally modified, is described as being a chimney-like structure, built of boards, having a height of about twenty-six feet, the other dimensions being five by seven feet. Inside this structure are placed a number of partitions of thin boards, spaced four inches apart, extending to within six feet of the bottom of the structure; but the lower halves of these partitions are placed at right angles to those in the upper portion, this arrangement giving better results than unbroken partitions.

The water to be cooled enters the structure at the top, where by the use of funnel-shaped troughs it is spread evenly over the partitions and walls, and flows downward in thin sheets instead of fine streams, as might be thought more desirable. Slender streams were tried, but were not as effective as the method finally adopted. At the base of the structure air is introduced in such quantity that the upward current has a velocity of about twenty feet per second. The air meeting the downward flow of water absorbs the heat by contact and also by vaporizing about 2 per cent of the water, reducing its temperature during the passage 27°, or from 83° to 56°.

The surface exposed per horse power is about thirty-three square feet. About the same dimensions would be required per ton of ammonia refrigeration, for the comparative amounts of water required for condensation of steam and ammonia are about the same in average practice. We are further informed, regarding this useful device, that the power required for raising the water increases the load on the engine about 3 per cent, and that required for maintaining the air blast 1½ to 3 per cent, making the whole power expended for handling and cooling the water not to exceed 6 per cent of the power developed by the engine. If a device of this kind proves so serviceable for steam condensing, it will serve an equally good purpose for ammonia, with dimensions of cooler and air blast the same, and the cost of operation will be in the same proportion per ton of refrigeration. For refrigerating purposes the temperature of the water would not be as high as that from the condensed steam, and the cooling effect would reduce the temperature of the condensing water below that of the supply usually obtained from an artesian well.

The device is simple, does not take much floor space and can be extended to any dimensions required in order to obtain the necessary amount of cooling surface. It could be easily erected on the roof of a building near the open air condenser, and being thus exposed to the wind could be arranged in such a way that a strong draft of air might be obtained for a great portion of the time without the use of a fan. That the device would prove serviceable and economical, may be inferred by comparing the difference in the amount of water required on a warm day by an open air condenser, when the atmosphere is quiet, and again when there is a strong breeze, for in the latter case a portion of the water is rapidly vaporized, reducing the temperature so that a smaller amount is required to perform the work. In summer time, when the weather is hot, the capacity of this heat-absorbing device is increased about two and one-half times on account of the more rapid evaporation of the water, so that the total quantity of water required remains nearly the same in summer or winter. But for ammonia condensation much less water would be required in cold weather. A peculiarity about the condensing water, after it has been used for some time and the air all expelled, is that it absorbs a greater quantity of heat than is apparently due to its temperature, or than would be the case with water containing air.

In comparing the cost of obtaining water by such means as are described above, or obtaining the supply from shallow drilled or artesian well, we find that economy is greatly in favor of the apparatus described, which would supply 100 tons of refrigeration at an expenditure of about 70-horse power, while a drilled well 175 feet in depth would require, to provide water for the same amount of refrigeration, an expenditure of upwards of 90-horse power. The water from the well would not be as cold as that produced by the use of the cooling devices, if the data given are at all reliable. Its reliability can hardly be questioned, however, as the description of it is obtained from a paper read before an institute of civil engineers, which mentioned thirty-five different establishments where the device had been installed. The largest plant contained 2,500-horse power, the engines working condensing and all the water being supplied in this manner. A careful calculation of all of the factors, so far as they can be supposed for an average plant, justifies the results expressed in the paper from which the details of the devices were obtained. The most expensive feature, perhaps, about the operation of the cooling device will be for raising the water to the required height, and for this reason greater cooling surface should be employed by broadening the structure, rather than adding to its height. A very important point in this consideration should be in the selection of a pump; and we wish to say, in forcible language, do not employ a simple steam pump, for it is the most expensive device extant for such purpose, as it requires 100 pounds and upwards of steam per horse power of work done. Compound pumps are not much more economical in the use of steam, consequently the opposite of this would be a power pump driven by the engine operating the compressor.

EGGS are now shipped from Australia to England. A trial shipment made by the Hon. J. H. Conner, of Victorian eggs and cheese, was lately inspected by an officer from the department of the agent-general for Victoria. With regard to the packing of the eggs, they had, in the first place, been rubbed over with grease and afterward placed with bran, flour, lime and pollard in small cases. When opened they were found to be perfectly fresh and sweet. The cheeses, which consisted of both forty pounds and "small loaf" sizes, were sound and of good flavor.

HON. Mr. Bordman has introduced a bill into the Iowa house making warehouse receipts apply to butter, cheese, eggs and dressed poultry, which, at our latest advice, had been ordered engrossed.

[*Written for* ICE AND REFRIGERATION.]

SOME DEBATABLE QUESTIONS.

COOLING SURFACE OF PIPES—OIL SEPARATORS—SINGLE AND DOUBLE-ACTING COMPRESSORS—DRY AND HUMID GAS—BOILING WATER FOR BREWING.

BY OTTO LUHR.

A GREAT many practical questions come up in the experience of an engineer, who has charge of ammonia compressors or other forms of machines used for refrigeration and ice making. Many of these questions are discussed in the engine room, when two or more engineers accustomed to the use of such machines are present, and as all are of theoretical and practical interest the effort is to obtain as much information regarding the principles as can be brought out by discussion. In Chicago there is an association of engineers composed wholly of those engaged in handling refrigerating and ice making machines, and seldom a meeting night passes but that one or more of the subjects connected with the business are discussed to a greater or less extent, and much useful information is received and given. Nearly everybody in his experience comes across some things which bother him more or less to understand, and often he has not the facilities at his command to put them to tests, so that he may determine the application and action of the principles under the conditions where they are called in question.

COOLING SURFACES OF PIPES.

A question, for example, was raised as to what portion of expansion pipes gave the most efficient cooling surface. Discussion on this subject was carried to considerable length by some of the members, who believed that the upper surface of the pipe was colder than the bottom. In explanation of this idea it was said that the liquid ammonia flowed along the bottom of the pipe and consequently the temperature at that portion was not as low as at the other parts where the gas was in contact. Others contended that the temperature must be the same, for there was sufficient conductivity to the liquid ammonia and also to iron, under the conditions, to maintain an equal temperature at all parts of the surface of the pipe.

This subject was interesting, and my reasoning was that the temperature should be the same, even though an investigation of the frost covered pipes showed that the upper surface was covered with a slightly thicker coating of frost, but this was probably due to the downward current of the warmer air which carries some moisture. To demonstrate it to my satisfaction, I drew a test bottle full of liquid ammonia and allowed it to evaporate in the open air, at a temperature of about 60°. The evaporation was much slower than one might have expected, but I soon found a satisfactory reason for it. Every test that I made on the glass bottle served to convince me that the temperature on that portion of the glass in contact with the liquid ammonia was lower than that of other portions of the test bottle in contact with gas only.

The ammonia evaporated slowly and the boiling was not very strong. The reason was readily found when a thermometer was introduced into the liquid. By this test some principles in connection with the evaporation of the liquid were brought more forcibly to my notice; one being the fact that the evaporation of the liquid, or its boiling, reduced the temperature to 28.5° below zero, that being the temperature of the liquid during the time it was boiling, or evaporating, rather, for the ebullition was hardly great enough to call it boiling. Above the surface of the liquid, but inside the bottle, the temperature was above the freezing point of water, so that no frost formed on that portion of the glass unless the liquid was violently agitated by shaking the bottle. When the thermometer was removed from the liquid and exposed to the air for a moment, the mercury column showed a reduction of temperature to 35° below zero. This reduction was brought about by the more rapid evaporation of the liquid which adhered to the bulb. The increased rapidity of evaporation was due, partly, to a greater difference in temperature than that to which it was exposed while in the bottle. By allowing liquid ammonia to flow on the bulb of the thermometer, and at the same time exposing it to a current of air so that the ammonia is more rapidly evaporated and fresh ammonia cooled by coming in contact with the already cold glass, a temperature a few degrees lower can be registered.

From the above experiment we might be led to draw conclusions differing somewhat from our common understanding of the action of ammonia within the expansion pipes. It was evident without the use of a thermometer that the temperature of that portion of the bottle in contact with gas only was above the freezing point, it being shown by the lack of a frosty coating such as covered other portions of the bottle, even the bottom part. When water was placed under the bottle so that the vapor came in contact with the glass, frost formed on the bottom of the bottle to a thickness equal to that on any other portion. While the ammonia was evaporating, the greatest action took place at the surface of the liquid, but at the same time small bubbles gathered on the inner surface of the glass beneath the liquid, showing that heat was being absorbed from beneath as well as through the sides of the bottle. The most interesting feature of the experiment was that the temperature of the gas was above the freezing point of water. That being the case in the bottle, why should not some difference exist in the pipes? And that part in contact with gas only, but possibly at a higher temperature, being heavily frosted, would show that iron is an excellent conductor of heat. So long as the pipes contain liquid, the cooling effect is strong; but where only gas is present, it soon becomes of the same temperature as the surroundings, because the gas has no latent heat. It is the latent heat of the liquid that is most effective, as the lower temperature of the gas is soon overcome, and by a small amount of heat, for the specific heat of ammonia gas is very low. Whenever we make experiments on things which we think we thoroughly understand, we generally run across certain manifestations that compel us to exercise our reasoning faculties very forcibly to make our practice agree with the theory (or *vice versa*, as you please), but they always do agree if carefully compared and the principles are fully understood.

OIL SEPARATORS.

The proper position in the circuit of oil tanks or separators is frequently discussed, some claiming that they should be placed between the compressor and the condenser, as the oil is then warmer and will not retain so much ammonia, while others claim that they should

be located beyond the condenser, for then the oil is cooler, heavier and will more quickly separate from the liquid.

The best way to settle that question is to find out the amount of ammonia contained in the oil under the different conditions. In one system the separators may be connected in one way and differently in another. In either case the best plan for the engineer is to use them as they are without making any particular change unless he is overhauling the plant, and then he can arrange them according to his notion. Some people always like to be making changes, to make things correspond with their ideas. This is particularly the case when a man takes hold of a new plant; and many times considerable of the boss's money is expended to no better purpose than carrying out some idea which practically is of very little value. I could give a great many illustrations of this principle and show where they have occurred, but it would do but little good except to call attention to the fact.

About the separators: I found that whenever I drew oil from the separators, which I do two or three times a week, there was enough ammonia in the oil to cause it to bubble and foam after being drawn from the tank, and it would smell strongly of the gas for a long time afterward. That appeared like an unnecessary waste; so I devised the following plan for separating the ammonia before drawing off the oil: On the bottom of the tank was a blind flange. This I drilled, and put in a piece of 2-inch pipe with a long thread at the lower end, the upper end being closed by a cap. Connecting this pipe with the steam supply, it formed a heater by which the oil could be warmed enough to drive out the ammonia, and as it was steam tight no steam or water came in contact with ammonia. This works most satisfactorily, as the oil is warmed but little and only a small amount of ammonia is retained in it. The valves on this tank must never be closed when warming the oil, or the pressure from the expanding ammonia might become so great, and in a very little time, as to burst the tank.

The oil used in refrigerating plants must be of suitable quality and of such properties that it will not get stiff at the low temperature to which it is subjected, neither may it vaporize at any temperature encountered in the compressor. A small quantity of oil, being more or less according to the way it is handled, will find its way into the system, and if it becomes stiff as it gets chilled, it will adhere to the pipes, in the brine tank and in direct expansion coils, the thickness constantly increasing until the efficiency of the pipes is greatly impaired on account of the low conductivity of the oil. An oil that will vaporize in the compressor will condense in the condenser, and by so doing will cover the inside of the pipes, making necessary the use of much more power for compression and more water for condensation than if the oil remained liquid and flowed along the bottom of the pipes.

DRY OR HUMID GAS.

The handling of compressors, whether dry or humid gas is used, while based on the same general principles, needs different manipulation of the expansion valve; for the admission of liquid ammonia to the compressor, intended for dry gas only would cause considerable trouble, with danger to the machine, while the use of dry gas in the other compressors would cause superheating, with no arrangement provided for overcoming it. Engineers who are accustomed to either system have considerable trouble, or some annoyance, when taking hold of a plant requiring different practice. A man who has been used to dry compression, and has handled such machines only, will be annoyed at the distance of the expansion valve from the compressor, and often he finds it difficult to understand that the expansion valve of a wet compression system seldom needs changing after once having been adjusted. On the other hand, a man who has been accustomed to wet compression only will find considerable difficulty in keeping the liquid ammonia out of the compressors. It is better that the ice machine engineer make himself familiar with both systems, for then he will feel at home with either, with which chance or the pursuit of his profession may throw him in contact. There is no single-acting compressor using humid gas and only one double-acting compressor designed for the use of dry gas (this uses oil for cooling); and if the conditions are varied so that the machine is required to work in a manner different from that for which it was designed, more or less trouble, bother or injury may result. With a single-acting compressor, using dry gas, the speed of the machine cannot be reduced, such as would be necessary in filling the oil cup on the crank pin, without flooding the cylinder with ammonia, unless extra precautions are taken; but with a double-acting compressor, using humid gas, you can slack the speed of the machine, and even stop it, without danger or trouble.

VERTICAL ENGINES, ETC.

The question of vertical engines and compressors as compared with horizontal machines, often comes up in one way or another for discussion. Some engineers, and the majority of them, so far as I have learned, consider that it is more trouble to care for the vertical machine, because it requires so much running up and down stairs; but with the horizontal machines everything is within easy reach and not much difference is found in adjusting clearance on either, for that is something that is governed by points that are brought to the engineer's notice with equal frequency on either machine.

BOILING WATER.

Nearly all engineers object to seeing steam wasted, or used in larger quantities than necessary, and for this reason the majority of them question the utility of boiling the water as long as is required by the brewmaster, who insists that it is necessary in order to soften it sufficiently. Such engineers as have studied the question of scale formation in a boiler consider that water is purified and softened by simply bringing it to a boil, for a few moments, as much as though it was boiled for hours. Some contend that continued boiling is of no benefit. This question is left unsettled because the engineer does not wish to interfere with the duties of the brewmaster, and so long as no special tests have been made in any particular plant the question will remain open, and is argued at some length whenever it is called up. As we need exact information on this subject to satisfy our minds, if for no other reason, I propose to make a special test some day to determine to what extent water is softened by boiling and how long it takes, unless some one writing for Ice and Refrigeration will give us an article on that subject. Full information regarding it would be of interest to the engineers in breweries especially.

ICE & REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION, THE TEXAS ICE MANUFACTURERS ASSOCIATION AND THE FLORIDA ICE MANUFACTURERS ASSOCIATION.

.·. APRIL, 1894 .·.

RATES OF SUBSCRIPTION.

IN ADVANCE, POSTAGE PREPAID.

United States, Canada and Mexico, - - - - - $2.00 a Year
All other Countries, - - - - - - - - 3.00 "

Single copies 25 cents. Advertising rates on application to the offices. Remittances must be made by post-office orders, postal notes, international money orders, checks or drafts on New York, Chicago or London, payable to H. S. RICH & Co.

H. S. RICH   S. P. FOWLER   J. F. NICKERSON   JNO. GLENN COLLINS

H. S. RICH & CO.

PUBLISHERS,

177 La Salle St., Cor. Monroe, CHICAGO.   206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

⁂ ICE AND REFRIGERATION, at the World's Columbian Exposition, received a medal and diploma for editorial, typographical and artistic excellence—the highest award given to any trade journal at that Exposition.

⁂ ICE AND REFRIGERATION is issued promptly on the 1st of each month. The first advertising forms go to press on the 20th, and the last on the 27th or 28th. Changes in advertisements should be sent in before the 20th.

INDEX TO ADVERTISERS.

ASSOCIATION MEETINGS.

[OFFICIAL NOTICES.]

THE annual convention of the South West Ice Manufacturers' Association will meet at Webb City, Mo., on the second Tuesday (being the 10th day) of April, 1894, to transact such business as may come before the Association. At the last annual meeting a resolution was adopted asking manufacturers of ammonia to present bids for a price at which they would supply members of the Association for the present season. Manufacturers are therefore requested to hand such bids to the secretary prior to April 10.

PITTSBURG, KAN., March 26.   O. T. BOAZ, *Sec'y.*

THE adjourned meeting of the Southern Ice Exchange will be held at Atlanta, Ga., April 11 and 12. Reduced railroad rates and for hotel charges at Kimball house have been arranged for. The meeting will be of great importance to every ice manufacturer in the territory of the Exchange.   CHAS. W. BIESE, *Pres.*

SOUTHERN ICE EXCHANGE.

THE adjourned meeting of the Southern Ice Exchange will be held at Atlanta, Ga., April 11 and 12; to which meeting, on behalf of the officers of the Exchange, ICE AND REFRIGERATION calls the special attention of its readers within its territory of the Exchange. The condition of the trade in that part of the South at this time is such as to make this coming meeting one, not alone of the utmost interest to ice manufacturers individually, but of vital importance to the trade as a whole. Some notion of the conditions obtaining may be obtained, if any be ignorant of them, by reading the correspondence collated under the heading of prices.

The officers have secured a reduction of railroad fare by the certificate plan, by which return fare at reduced rates will be given to holders of certificates of attendance, provided 100 persons attend. Those who attend should therefore, on buying their tickets, take also receipts for the amount paid as vouchers on which to obtain return tickets.

HONOR bright, now, this is really the latest, and it comes from Montreal, Canada, where, of course, they never exaggerate about ice: The Truthful James who informs the outer world of men and events in this historic old town says, February 27: "Negotiations are being entered into here by a number of Boston and New York capitalists with a view of securing rights in the United States for the new method of making ice. The ice is not made by an artificial method, being allowed to freeze in an open space, but a patent filter purifies the water and also renders it more susceptible to freezing. Ice by this method costs about eight cents a ton, packed."

THE ICE TRADE

[*Special Reports to* ICE AND REFRIGERATION.]

PRICES FOR 1894.

QUOTATIONS OF PRICES FROM ALL PARTS OF THE UNITED STATES—THE PROSPECTS FOR THE APPROACHING RETAIL SEASON—REMARKS OF CORRESPONDENTS.

THE prices quoted below have been kindly sent in by the parties or companies named in response to circulars sent to a number of our subscribers. The editor would be pleased to continue the quotations in the May issue, and hereby requests every reader of this paragraph to send his own card of rates to this office by return mail, whether he has or has not received the circular letter.

It is hardly necessary to make any comment on the quotations made, or on the remarks of our correspondents. The outlook generally is very favorable; but here and there the conditions are reversed, for reasons named, and to these comments the editor especially calls the attention of the reader, since in most cases the presentation made of the difficulties in the way of a remunerative business likewise suggest a remedy.

Where the business is in bad shape, it is always by reason of the inordinate covetousness of some, and the mistaken business ideas of others. The price destroyer always creates his own Nemesis—is his own destroyer. The thought is an old one, but many have yet to take it home to themselves.

With these barest suggestions we commend the following prices to the reader's consideration:

ALABAMA.

Birmingham.—City Delivery Co.: Prices same as last year, to wit, 100 lbs., 25c.; 50 lbs., 15c.; 25 lbs., 10c.; 10 lbs., 5c.

ARKANSAS.

Hot Springs.—Consumers' Ice Co.: Wholesale car load lots, $6 per ton, retail, 40@60c. per cwt., price being governed by amount of ice used.

Little Rock.—Little Rock Ice Co.; Wholesale in car loads, from $2.50@$4 per ton; retail, from 35@50c. per cwt. Competition all around us is quite sharp, and prices drop lower and lower each year.

CALIFORNIA.

Sacramento.—Compiled from the *Bee:* On March 1 it was announced that the local ice companies had "pooled their issues," and that the retail price of ice had advanced from 40c. to 75c. per cwt. It appeared later, however, that the family trade rate had not been advanced, being 1c. per lb., as it has been for four years past. Wholesale, manufactured by Buffalo Brewing Co., $8 per ton.

San Francisco.—Consumers' Ice Co.: Our present prices for ice are $4 per ton at factory in large lots; $5 in car load lots, f. o. b., and the same to large consumers in the city; that is, in 2 to 5-ton lots. The retail prices depend on the size of lot, distance handled, as well as elevation, say from 40c.@$1 per cwt. Our city is one of large distances and great elevations, as well as small consumers. Our climate in this city is cool in summer, as well as winter, and the consumption of ice is small compared to other cities. We expect an increased demand for our ice the coming season—although we can hardly expect a demand for all we can make—about 70 tons daily.

CONNECTICUT.

Bridgeport.—Naugatuck Valley Ice Co: In this city there will be no change in the prices of ice for the coming season from those of last year, to wit: Markets, 20c. per cwt.; saloons, 30c., and families, 40c.

DELAWARE.

Wilmington.—Diamond Ice Co. Prices are maintained on last year's basis, to wit: Wholesale, $3 per ton; retail, 5 lbs. daily, 35c. per week; 10 lbs., 49c.; 15 lbs., 63c.; 20 lbs., 84c.; 25 lbs. and over, at the rate of 50c. per cwt. No ice has been housed in the vicinity, and we consequently look for quite a demand for car load lots, and we are in good shape to handle our share.

FLORIDA.

Tallahassee—Tallahassee Ice Co.: 5 to 10 lbs., delivered, 1c. lb.; 25 lbs. daily, 75c. per cwt.; 10 lbs., 50c. No natural ice made or brought to this section.

Tarpon Springs.—The Florida West Coast Co.: Our prices wholesale by car lots, $5 per ton; less than car lots and not less than one ton, $6; retail delivered packed at 65c. per cwt.; at residence, 50c. Our trade is fairly good, the ice being mostly used for packing fish, of which we have a large supply here. We have now finished the third steamer to carry fish from fish camps to the packing house, which is located near the factory. We are in hope soon to open a trade in the East and West for the deep water fish which can be caught here in large quantities. The Spanish fishing smacks fish off our shore and frequently as many as 10 to 15 come in our harbor at a time in case of storm.

Titusville.—Indian River Ice Manufactory: Our largest customers are the fishermen, who take about one-half of our output of six tons per day, our plant being a small one. Our price to them as they call for it is $5.50 per ton; to markets, hotels, etc., 200 lbs. per day and upwards, $10 per ton; 100 lbs. delivered from wagon, 65c.; for family use we sell 11 10-lb. tickets for $1, or 22 5-lb. tickets for $1.

GEORGIA.

Rome.—Rome Ice Mfg. Co.: Car lots, $5 per ton, f. o. b., Rome; ton or more, sacked, 40c. per cwt.; less quantities, 50c. Retail city trade: To butchers, saloons, restaurants, soda water fountains and cold storage men, 35c. per cwt., in any quantities; to private consumers, 50c. per cwt., in 100-lb. lots; single deliveries of 75 lbs., 40c.; 50 lbs., 30c.; 40 lbs., 25c.; 25 lbs., 20c.; less than 15 lbs., 1c. per lb. As a reduction from the above, and as an inducement to consumers, we sell 5c. tickets as follows: In $1@$4 lots, 22 5c. tickets for $1; in $5@$9 lots, 23 tickets for $1; in $10@$20 lots, 24 tickets for $1; in $25 lots, 25 tickets for $1. We find that these scales give very good satisfaction. We anticipate a good, long and prosperous season this year, and it is our opinion that if the manufactories in neighboring towns will get together and agree to our price, thereby protecting themselves against small dealers buying from one factory and shipping in and selling against another, they will reap a harvest.

ILLINOIS.

Cairo.—Distilled Water Ice Mfg. Co.: We anticipate a heavy trade this season by reason of no natural ice being secured in our operating region. We are still delivering at last year's prices, viz., 30c. to families and 25c. to saloons and butchers and wholesale at factory, 20c.

Chicago.—Consumers' Pure Ice Co.: Our prices for the coming season will be as follows: Retail, single deliveries of 25 lbs., 50c. per cwt.; 50 to 100 lbs., 40c.; 200 lbs., 30c.; 500 to 1,000 lbs., 25c. In wholesale lots they will range from 15@20c. per cwt.

J. P. Smith & Co. (Wisconsin lake ice): Approximately our prices are as follows: Fifteen lbs. daily, 60c. per week; 100 lbs. at one time, 35@40c. per cwt.; by ton $3@$3.50; restaurants and saloons, 15@20c. per cwt. Wisconsin gave most of the harvest of ice. There is a shortage from the usual amount put up, when Illinois gives us an ice harvest. Much thin ice was harvested the first of the freeze. We think ice will be scarce and prices stiffer the last of the season or if we have severe hot weather in July and August. Ice cut late in Wisconsin is fine; probably 300,000 tons cut in that state.

Washington Ice Co.: Saloons, 25c.; butchers, 30c.; single deliveries of 50 to 200 lbs., per cwt., 40c.; 200 to 500 lbs., 30c.; 500 to 1,000 lbs., 25c.; family and office trade, daily deliveries, per week, 15 lbs., 60c.; 20 lbs., 70c.; 25 lbs., 85c.; 30 lbs., $1.

East St. Louis.—East St. Louis Ice and Cold Storage Co.: We wholesale only; and at this time (March 17) the ice is $3 per ton to St. Louis dealers, a slight advance since March 15. "The writer understands that the majority of the natural ice housed within a shipping rate of 75 cts. to $1.05 is very badly peppered. Ice further north, Wisconsin and Minnesota, is of a very fine quality, about 22 in. thick, but the freight rate from there to St. Louis is $2 per ton, and they could only ship to realize a profit if ice went to $3.50 or $4 laid down in car loads St. Louis." [In February or early March, northern ice was selling on track in St. Louis at $2.60 per ton.—ED.]

Macomb.—John Gesler: Our wholesale price is $4 per ton and retail $8 delivered in ice box. The general prices around this vicinity are $5 wholesale and $10 retail. The quantity of ice housed is about one-fourth more than last year, but the quality is not so good—runs from 5 to 9 inches thick. It is much harder to please the trade than it has been previous years.

Springfield.—Pure Ice and Cold Storage Co.: Prices city delivery, daily, per month: 5 lbs., $1.75; 10 lbs., $2.75; 15 lbs., 3.50; 20 lbs., $3.75; 25 lbs., $4. Single deliveries, per cwt., 30 to 100 lbs, 50c.; 200 to 300 lbs., 40c.; 400 to 900 lbs., 30c.; 1,000 lbs. or over, 25c.; 2,000 lbs. or over per week, 35c.; no Sunday deliveries. Wholesale at ice houses or factory, $4 per ton or 30c. per cwt.; less than 100 lbs., at rate of 40c. The present prospects are favorable for a good summer's trade, "St. Patrick's Day" starting out as warm as July 4.

INDIANA.

Edinburgh.—Edinburgh Ice and Light Co.: No ice has been put up in this part of Indiana this season, and the outlook for manufactured ice is good. We are now (March 16) starting up for the season. Our prices are as follows: Saloons and butchers, in 400 or 500-lb. lots, in one delivery, 25c. per cwt.; families, 40c. per cwt.; ton lots, $4 per ton; car lots, $3 per ton. No ice has been put up south of Indianapolis, and there it was only four inches thick—ice of no value.

Lafayette.—Lafayette Artificial Ice Co.: We harvested about 6,000 tons of 7 to 8½-inch ice, which is about one-eighth of our storage capacity. We also have about 6,000 tons of old ice, 10 to 16 inches thick. We are giving options on this thin ice, good to June 1, at $1.50 per ton on cars here, and are booking a great many ten and twenty-car orders from small towns. At present we can see no reason why we should not get better prices before the season closes, and are holding the thick ice. To our retail trade we are furnishing the artificial ice at same prices as last year, 15, 20, 25 and 30 cents per cwt., which is very low for a city the size of Lafayette, and we could not sustain ourselves at such prices if it were not for our wholesale trade. It is needless for us to mention our reasons for prices being so low at retail, and may say we have made contracts this month for two years taking 70 per cent of the whole consumption.

IOWA.

Burlington.—M. Dunn & Co. (James S. Klein concurs): The following is the price list agreed to by the dealers of this city, figures quoted being per cwt.: Butchers—1,000 lbs. and over, on sidewalk, 20c.; put in box (they to furnish man in box), 25c. Saloons—100 lbs. and over, 35c. Ice cream parlors—100 lbs. to 500 lbs., 30c.; 500 lbs. to 1,000 lbs., 25c.; over 1,000 lbs., 20c. Soda fountains, same as ice cream parlors. Groceries—put in box, 35c.; delivered on sidewalk, 30c. Restaurants, not saloons, same as groceries. Hotels—100 lbs to 300 lbs., daily, 30c.; over 300 lbs., 25c. Families—75 lbs. and over at one delivery, 40c.; 30 lbs. to 75 lbs. at one delivery, 50c.; less than 30 lbs., 60c. Shop prices—6 deliveries, 15 lbs. each, per week, 50c.; extra Saturday evening, pieces, each, 15c.; 3 pieces, daily, 15 lbs. each, per week, $1.25.

Davenport.—Crystal Ice and Cold Storage Co.: Our rate for butchers is 15c. per cwt.; saloons, restaurants, etc., 20c. per cwt. Natural ice is a short crop, but prices are only slightly raised. To the family trade and offices our terms and prices are as follows: Coupon books of 1,000 lbs., each, first book, $3.50; second, $3.25; third, $3; fourth, $2.75; fifth, $2.50; all subsequent books, each, $2.50, issued to one party and ice delivered to one address only. Books are not transferable. No ice will be sold for cash from the wagons. It will be furnished to holders of books only. Books to be paid for on first of month following date of issue. Any unused portion of book is redeemable in cash at same rate as paid.

Des Moines.—Des Moines Ice and Cold Storage Co: Price list for 1894—family rates: 15 lbs. daily, natural ice, 50c.; manufactured 60c. per week; 20 lbs., 60c. and 75c. respectively; 30 lbs., 75c. and $1. Washing and putting away, 25c. extra per week. Per cwt., 40 to 200 lbs. at one time, natural ice, 35c.; manufactured, 40c. Business house rates, per cwt., 5 to 200 lbs, at one time, 30c.; 200 to 500 lbs., 20c.; 800 to 8,000 lbs. or more, 12½@15c. Are sorry to say that there is no union or exchange here, and no agreement as to prices. It is "every one for himself and the d——l take the hindmost." We shall run about eighteen wagons, but as usual the small companies, of which we have three, make, to a certain extent, the prices, and we are compelled to accept their prices or lose our customers. We will have quite a business on manufactured ice, as a great many of our people prefer it to natural ice, as it is certainly much cleaner.

Fort Madison.—F. C. Schaper: Ice will sell for 25@50c. per cwt., according to quantity.

KANSAS.

Hutchinson.—Union Ice and Salt Co.: The natural ice harvest here and vicinity has not been very good although the natural ice men made the most of it. We are selling ice at $3 per ton in car load lots until July 1; have made no prices after that date.

Wichita.—Crystal Ice Co.: Our retail prices for family delivery: 1,000-lb. coupon tickets, not less than 50 lbs. at each delivery, $5; 500-lb. coupon tickets, not less than 25 lbs. at each delivery, $3; 200-lb. coupon tickets, not less than 10 lbs. at each delivery, $1.50; to butchers, 25c. per cwt; to hotels, 25c.; wholesale, f. o. b., $3 to $3.75 per ton. We paid a 10 per cent dividend on $100,000 capital last year, and hope to do the same this year.

Winfield.—C. M. Gay: Prices have not been established as yet, but expect them to run about as follows, viz.: Butchers and confectioners, 40c. per cwt.; ton lots, 30c.; car lots, $4.50 per ton; family trade, 60c. to $1.00 per cwt.

KENTUCKY.

Louisville.—The Pictet Spring Water Ice Co., Incorp: The manufacturers held a meeting, and decided upon the following: At platform—to peddlers, $3.50 per ton; trade, can of 200 lbs., 40c.. can of 300 lbs., 60c.; will not cut cans. The peddlers decided upon the following prices: Wholesale—Hotels, railroads, etc., naming them, per ton $5; others than those named, $6; to butchers, saloons, confectioneries, 35c. per cwt., or per ton delivered, $5.50; families—under 25 lbs., one delivery at 75c. per cwt.; over 25 lbs., 50c.

LOUISIANA.

Donaldsonville.—Donaldsonville Ice Co., Limited: We quote prices on ice wholesale and retail for the coming season as follows: Wholesale, $8 per ton; retail, $12. Natural ice throughout our section is a thing of the past. The prospects of the ice trade for the coming season are excellent. We have a 15-ton plant, and by all probability will double its capacity next season.

MARYLAND.

Baltimore.—Biemiller Ice and Coal Co.: The prospects here of prices are that they will remain the same as last year, viz.: Families, 10 lbs., 5c.; 25 lbs. and over, 40c. per cwt.; stores, restaurants, etc., 30c.; ton lots, $5; 10 tons and upwards, $4 per ton.

Hagerstown.—Hagerstown Ice Co.: Our retail prices for the season of 1893 are as follows: Butchers and confectioners, 25c. per cwt.; saloons, 30c. per cwt.; private families, 50c. per cwt.; we have not made prices for the season in car load lots, but do not expect to get high prices, although very little has been cut in our section.

MASSACHUSETTS.

North Adams.—John J. Marsh: Prices in North Adams, 35c. per cwt. for domestic use; 15c. for hotels, markets, etc. Prices in Adams are the same.

Springfield.—*Union*, February 10: Ice was sold to families last year for 30c. per cwt., and it is likely that the price this coming summer will be about the same, although the prices will not be fixed till the latter part of March.

MICHIGAN.

Detroit.—*Tribune*, February 24: Chas. A. Dean, of Pittmans & Dean, says: "We cannot tell what this year's price will be until the ice is all in; think there will be a little advance in prices." The price last year was 15c. per cwt., wholesale, and $2 per month one piece daily. In 1890 the wholesale price was 50c. per cwt.

MINNESOTA.

Duluth.—Duluth Ice Co.: The following prices have been established by the dealers for the summer of 1894: Per ton, boxed, in lots of 6,000 lbs., $2.50; 2,000 to 6,000 lbs., $3; per cwt.—lots of 1,000 to 1,500 lbs., 20c.; 100 to 1,000 lbs., 35c; family trade, $2@$3 per month; car lots, $2 per ton, f. o. b. Duluth. The season here usually begins about May 15 and ends October 15. We are unable now to say much as to the prospects, but the present weather indicates an unusually early season.

MISSISSIPPI.

Columbus.—Sam'l Kaye: My prices on ice for this season are as follows: 1c. per pound in small pieces; 60c. per cwt. to retail trade; 50c. per cwt. to hotels, soda fountains, etc., 50c. per cwt. in sacks to shipping trade. No natural ice put up here.

MISSOURI.

Kansas City.—Kansas City Ice and Cold Storage Co.: Prices on ice after March 1: Per cwt. to butchers, hotels, drug stores, milk dairies, saloons, groceries, restaurants, confectioneries, 25c.; market houses (except small customers), candy and cracker factories, express companies, 20c.; offices, residences and boarding houses, as follows: Offices—10 lbs. per day, $3 per month; 20 lbs. per day, $4 per month. Families, per cwt.—20 lbs. per day, 80c.; 30 to 40 lbs. per day, 60c.; 50 lbs. and over, per day 50c.; to peddlers, only on our docks, $3.50 per ton. The prospects for the coming season are only fair.

St. Louis Ice Mfg. and Cold Storage Co.: The wholesale price for machine and natural ice is now about $3 per ton at the tank. The prices at which contracts are being made for the season to supply butchers, as well as large consumers, range from $4.50 to $5 per ton. The family rate will be about 40 to 50 cents per cwt.

Tamm Ice and Cold Storage Co.: We are now selling ice at factory at $3 per ton; those taking less than two blocks, $3.50 per ton. We have refused to make contracts, and will not make one with anybody at any price. We believe, however, that we will average, say from May 1 until October 1, about $4.50 per ton at factory. We are going to put on two delivery wagons April 1, and expect to get $10 per ton for the season.

Springfield.—Springfield Ice and Refrigerating Co.: Our prices this season will be as follows: 100 lbs. and over, 40c. per cwt.; 50 to 100 lbs., 60c.; 25 to 50 lbs., 75c.; and less than 25 lbs., $1 per cwt.; car lots, $3.50.

MONTANA.

Helena.—Helena Ice Co.: Our prices are as follows: Retail price, 50c. per cwt. to family trade; wholesale, $3.50 per ton, load lots; 25c. per cwt. to saloons, etc. Quantity housed, 8,000 to 10,000 tons; quality, the finest, 16 to 18 inches thick; prospects of trade, good, though the price, through competition, is too low for this locality. Last year the retail price was 75c. per cwt., washed and put away.

NEBRASKA.

Lincoln.—Lincoln Ice Co.: The prices for the coming season run from 10 to 33c. per cwt.; 10 and 15c. for cold storage and butchers, and 20 to 33c. for the family trade. These are what we call "starvation prices." The prospects are rather favorable for earlier trade than usual.

South Omaha.—South Omaha Ice and Coal Co.: This day, the 17th of March, finds us with the thermometer at 80° above in the shade, which is very warm for this season of the year. All the butchers have had their boxes filled, which is at least a full month in advance of former years. We have seven companies in the ice business this year, being an increase of one company, and all have a full supply of ice. The total amount harvested will probably show an increase of from 7,000 to 10,000 tons over that harvested last season. Prices are established on the same basis as last year, with some of the companies using the coupon book system, and others making weekly collections. All the companies have concluded that the ice business must be run much nearer a cash basis than it has been to make a success of it. The prices as established are as follows: Hotels using from 500 to 600 tons during the season, $2.50 per ton; small hotels, using less, $3 to $3.50; breweries, 500 to 600 tons, $2.50; meat markets, taking 2,500 lbs. each delivery, $3 per ton; in less quantities, $3.50 and $4; saloons, 25c. per cwt., except such as use 2,500 lbs. at each delivery, $3.50 per ton; restaurants, 25c. per cwt., except such as use 2,500 lbs. at each delivery, $3 per ton; ice cream and candy manufacturers, $2.50 per ton; drug stores taking from 200 to 400 lbs., 25c.; 400 lbs. and upward, 20c.; all others, 30c. per cwt.; groceries taking whole cakes, 25c. per cwt.; less than that, 30c. per cwt.; families using 500 lbs. and upward, 25c. per cwt.; using 50 lbs., each delivery, 40c.; less than 50 lbs., 50c. per cwt. We shall not make any monthly rates this season, but continue as we did last season, sell by weight only.

NEW JERSEY.

Holly Beach.—F. E. Smith: My price list for the coming year is as follows: 1 ton lots, $6; 100-lb. lots, 40c.; 25 to 50-lb. lots, 50c. per cwt.; 10 to 20 lbs., at one time, 75c. per cwt.; 5 lbs. daily (seven days), 30c. These are the same as last year's prices.

NEW YORK.

Syracuse.—Chas. Listman: Prices on and after March 19: Per cwt., less than 200 lbs., 30c.; 200 to 1,000 lbs., 25c.; 1,000 lbs. and over, 20c.; daily, by the week, 10 lbs., 50c.; 15 lbs., 60c.; 20 lbs., 70c.; 25 lbs., 80c.; by the month, daily deliveries of 10 lbs., $1.60; 15 lbs., $2; 20 lbs., $2.40; 25 lbs., $2.80; 30 lbs., $3.20; 35 lbs., $3.60. All bills are due and payable at the end of month.

NORTH CAROLINA.

Elizabeth City.—Elizabeth City Crystal Ice Co., Flora & Brockett, Props.: Factory and wagon list, commencing May 1, 1893: Less than 20 lbs., one delivery, 1c. per lb.; deliveries of 20 to 50 lbs., ¾c. per lb.; 50 to 100 lbs., ½c.; per cwt., 200 to 500 lbs., 40c.; 500 to 1,000 lbs., 30c.; 1,000 to 2,000 lbs., 25c.; 5-ton lots, $4.50 per ton; 10-ton lots, $4. Quotations for larger quantities furnished upon application; ice packed in box, bbls., etc., 10c. per cwt. extra. The ice wagon will make one delivery daily until June 15, and two trips daily thereafter until September 1. Factory will be open for sale of ice daily and Sunday until 10 o'clock.

Wilmington.—Wm. E. Worth: The ice trade in this section of the state is in a very unsatisfactory condition. There are no settled prices here, and there are two of us in the field now and we each get what we can. You and the general public engaged in this line of business know what that means.

OHIO.

Canton.—Artificial Ice and Storage Co.: We announced March 7 the following prices for the ensuing year, the quantities named to be taken at a single delivery: From 10 to 50 lbs., 50c. per cwt.; 50 to 100 lbs., 40c.; 100 to 500 lbs., 35c.; 500 to 1,000 lbs., 30c.; 1,000 to 3,000 lbs., 25c.; 3,000 to 24,000 lbs., 20c.; ice delivered at works in quantities of 1,000 lbs. or upward, 20c. per cwt.; in smaller quantities, 5c. per cwt. less than the prices given above. No ice will be sold on Sundays.

Cleveland.—Cleveland Ice and Refrigerating Co.: We cannot give prices which will prevail during the coming season, as they have not as yet been determined on. The outlook for the ice business here this year is very good, and think we will get very good prices, and do a large business. As to storing manufactured ice, we cannot give you any information, as we have not as yet tried it, but are going to do something in that line this next year. We do not deliver any ice, but sell all that we make at the platform.

Cincinnati.—Cincinnati Ice Mfg. and Cold Storage Co. in *Tribune:* The demand for ice is very large; 25c. per cwt. is as low as it will be; $5 per ton is low enough, and there is scarcely a dealer in natural ice that can land it here this winter for less than $3 per ton, and it is worth from $2 to $2.25 to handle it. Ice will undoubtedly be higher this summer than last.

Columbus.—Jaeger Diamond Lake Ice Co.: We cannot give you any satisfactory information in regard to prices, as "there is blood on the moon" and likely to continue the whole season, which means last year's prices. This state of affairs was necessary in order to teach some dealers to have more regard for truth and veracity. There was very little ice put up here; some dealers got none, others very little.

Marion.—Marion Ice and Cold Storage Co.: Our price for the season will remain same as last, viz.: Butchers, 20c.; saloons, 25c.; grocers, 30c., and domestic trade, 35c. per cwt. What lake ice will be sold here this summer will command the same price as the artificial. We start out this year (our second year) with a trade established, and our competition will not amount to much. We are now running to full capacity, and prospects for a good season are encouraging.

Portsmouth.—Portsmouth Brewing and Ice Co.: Retail price for ice here—for less than 100 lbs., 50c. per cwt.; for above 100 lbs., 40c.; car loads, $3 ton now, later on market price.

Zanesville.—Zanesville Artificial Ice Co.: There has been no price named for summer delivery. At present and until future notice the trade is being furnished at the following rates per cwt.: Butchers, by wagon load, $4 per ton; butchers, saloons and groceries with meat box, 25c.; small saloons and factories, 30c.; family trade, 100 lbs. each delivery, 35c.; 25 lbs. and over, 40c.; less than 25 lbs., 50c. There was about 3,000 tons of ice, from four to five and a half inches thick, put up here, which has quite an effect on our retail trade at present.

OKLAHOMA TY.

North Enid.—Enid Ice and Cold Storage Co: We have hardly established a price yet, but think ice will be retailed at 50c. @ 75c. per cwt.; wholesale, $4 per ton, f. o. b. cars. There was no ice cut here this past winter. Caldwell, Kan., was the nearest to this point, and there they only got about 100 tons of 4-inch ice, and quality not very good. Wellington, Kan., got a small quantity also. The outlook is for a fine trade and good prices, if manufacturers will sustain the price and not cut it for business. It is entirely unnecessary to do so, as all machines through this section will have their entire capacity taxed to supply the demand soon as season opens up. We expect all we can do in the next three weeks.

PENNSYLVANIA.

Altoona.—Pennsylvania Ice Co., Limited: Retail price list, 1894: Per cwt., butchers, hotels, ice cream makers, 25c.; drug stores, 30.; ice cream saloons and restaurants, 35c.; grocers, 40c.; families, 10 to 25 lbs. per day, 60c. per cwt.; 25 lbs. or more per day, 50c. Our prospects for the season are fairly good.

Germantown, Phila.—Ice Mfg. Co., of Germantown: Will say that we have had more inquiry this year for ice at 25c. this season of the year than for any season to the writer's knowledge; and our shipping trade is better than ever before—have not enough ice for the demand. Prices, f. o. b. Germantown, this season, will be at least $4 per ton, and the retail price will be 40c. per cwt. and a notch higher on all the regular card rates. Business looks as if this would be a banner year for all manufacturers in this section of the country. The natural people are hunting and scraping already for ice, and no one will know what it will be before the season is over.

McKeesport.—McKeesport and Youghiogheny Ice Co.: Our wholesale rates per cwt. are as follows: 700 to 1,000 lbs. ice per week, 35c. per cwt.; 1,000 to 1,400 lbs., 30c.; 1,400 to 2,000 lbs., 28c.; 2,000 to 2,800 lbs., 25c.; 2,800 to 4,000 lbs., 23c.; 4,000 lbs. and over, 20c. Our retail list is as follows: 10 lbs. 6 deliveries, 48c. per week, 7 deliveries, 56c. per week; 15 lbs. 6 deliveries, 66c., 7 deliveries, 77c.; 20 lbs. 6 deliveries, 84c., 7 deliveries, 98c.; 25 lbs. 6 deliveries, $1.02, 7 deliveries, $1.19; 30 lbs. 6 deliveries, $1.14, 7 deliveries, $1.33; 35 lbs. 6 deliveries, $1.26, 7 deliveries, $1.47; 40 lbs. 6 deliveries, $1.38, 7 deliveries, $1.61; 50 lbs. twice a week, 63c. per cwt.; 100 lbs. and over, 2 deliveries per week, 50c. per cwt. The ice crop here was a failure, no ice put up at all, and the prospect for a good trade this season looks bright.

Pittsburgh.—The Eureka Ice Co.: Retail price list from April 1: 10 lbs. 6 deliveries, 48c. per week, 7 deliveries, 56c. per week; 15 lbs. 6 deliveries, 66c. per week, 7 deliveries, 77c. per week; 20 lbs. 6 deliveries, 84c. per week, 7 deliveries, 98c. per week; 25 lbs. 6 deliveries, $1.02 week, 7 deliveries, $1.19 per week; 30 lbs. 6 deliveries, $1.14 per week, 7 deliveries, $1.33 per week; 35 lbs. 6 deliveries, $1.26 per week, 7 deliveries, $1.47 per week; 40 lbs. 6 deliveries, $1.38 per week, 7 deliveries, $1.61 per week; 50 lbs. 2 times per week, 63c. per week; 50 lbs. 3 times per week, 93c. per week; 100 lbs. 2 times per week, $1 per week; 100 lbs. 3 times per week, $1.35 per week; 100 lbs. 4 times per week, $1.60 per week. These prices are guaranteed for one year.

Wilkes Barre.—Ice Mfg. and Cold Storage Co.: Price list, retail: daily deliveries, per week, 10 lbs., 35c.; 15 lbs., 45c.; 20 lbs., 55c.; 25 lbs., 65c.; 30 lbs., 75c.; 40 lbs. $1; 50 to 100 lbs., 30c. per cwt.; 100 to 400 lbs., 25c.; price for larger quantities, $2 per ton at the factory. Coupon books are used and found satisfactory, avoiding disputes, delays and mistakes. We will have to double our capacity to keep pace with the trade; outlook for this season —more than we can do.

RHODE ISLAND.

Providence.—Earl, Carpenter & Sons: The prices for the coming season, which with us begins May 1, have not been established yet. The dealers here are still selling at last season's prices, which by the wholesale card was $3 per ton, with special lower rates to large consumers. We are inclined now to believe that the rate for the coming season will be $1 more, viz., $4 per ton. The local ice crop is somewhat short, and much of it of inferior quality. The ponds around Providence froze over early (about December 6), but before the ice became thick enough to hold up horses, snow storms came, and rains followed, then more snow, so that when ice cutting around here began, about February 15, the average ice was from 9 to 10 inches thick; 5 to 7 inches of it being snow ice. After talking with some of the other dealers, we are inclined to think that Providence is short about one-quarter of the full capacity of the storehouses. This of course means that with a fairly warm season no ice will be carried over; some of the dealers may have to buy a little, and others will probably just about squeeze through.

SOUTH CAROLINA.

Charleston.—Charleston Ice Mfg. Co. Price list of ice March 20, at Charleston: 2,000 lbs. delivered, $6; 1,000 lbs. delivered, $3.50; 500 lbs., $2; 100 lbs., 40c.; 50 lbs., 25c.; 25 lbs.: 15c.; 13 lbs., 10c.; 6 lbs., 5c.

Greenville.—Piedmont Ice Co.: Retail prices per cwt., single deliveries of 100 lbs., 50c.; 50 lbs., 70c.; 25 lbs., 80c.; 15 lbs., 10 lbs. or 5 lbs., $1. Wagons make two deliveries per day in residence parts and four in the business part of the city, Sundays excepted; no ice sold Sunday when factory is closed; no rebate in sacks (55c. per cwt. straight); coupon books at $1, $3 and $5 each.

Sumter.—Sumter Ice Mfg. Co.: Our price for ice here at retail will be 50c. per cwt. We are now quoting at $4 per ton f. o. b. here by the car lot, but our price for the season will of course be governed by our competitors, unless we can all agree on terms for the trade in car lot shipments. There has been no natural ice harvested in this section of the country.

TENNESSEE.

Bristol.—Diamond Ice Co.: Our prices as follows per cwt.: Lots of 50 to 500 lbs., 50c.; 500 to 1,000 lbs., 40c.; 25 to 50 lbs., 60c.; less than 25 lbs., 75c. No natural ice harvested in this section.

Chattanooga.—C. W. Biese, of Lookout Ice and Cold Storage Co.: I delayed my report hoping that our companies would fix a price before the first of April, but up to date nothing positive has been done; we are selling at present at the same price as we sold last year, as below. I am sure that the prices for families will not be raised, but hope that the wholesale prices will be more. Should a change occur will inform you. We will deliver at following rates per cwt.: 1,000 lbs. and over, 25c.; 500 to 1,000 lbs., 30c.; 100 to 500 lbs., 35c.; 50 to 100 lbs., 50c.; 25 to 50 lbs., 60c. Coupon books containing sixteen 10-lb. tickets, $1; books for 160 to 5,000 lbs. each, sold at office.

Clarksville.—Clarksville Ice and Coal Co.: Ice delivered to saloons, hotels, butchers and confectioners having soda fountains, 50 lbs. or more at one delivery, 50c. per cwt.; less than 50 lbs. at one time, $1; to boarding houses, groceries, families and other small consumers, 100 lbs. or more at one delivery, 50c. per cwt.; 50 lbs. or more at one time, 60c. per cwt.; less than 50 lbs., $1. Special prices to large consumers and to parties taking it in ton lots. Price per cwt. in lots of half ton or over: 4-ton lots or over, 20c.; 2-ton lots and under 4 tons, 25c.; 1-ton lots and under 2 tons, 30c.; ½ ton and under 1 ton, 35c.; in car loads, $3 to $4 per ton. Our prospects for a good trade are very flattering.

Harriman.—Emory River Ice Co.: The winter has been mild; no ice has been cut in this section, and indications point to an early opening of the season and a successful year. We are quoting: Car load lots, $3 per ton f. o. b. here; butchers and others using 300 lbs. per day, 35c. per cwt.; packed and sacked for shipment, 50c. Family trade, by the coupon system, 50 lbs. and over, 60c. per cwt.; less quantity, 70c. A discount of 10c. per cwt. is made where coupon books are paid for on delivery. Small cash trade, 1c. per lb.

Jackson.—Tennessee Ice Co.: We quote f. o. b. cars, March 13, packed in any quantity: 50c. per cwt.; loose in car, less than 5 tons, $6 per ton; 5 tons and less than 12, $5; 12 tons and over, $4.50. Winter very mild; no natural ice put up; prospects for machines fairly good.

Knoxville.—Knoxville Ice Co.: Ice is sold here at present. What little there is sold, at the same price as last season, viz.: From 30c. to 40c. per cwt., according to the quantity a customer takes. The wholesale price is from $3 to $4 per ton, in car load lots, but so far this season we have had no chance to fill car load orders. The manufacturers are waiting for the adjourned meeting of the Southern Ice Exchange at Atlanta next month before they offer ice or change the last season's price. There was no natural ice made in East Tennessee; the weather was too warm. Ice never formed over ½ to 1 inch thick at any time of the few cold days we had. I think the outlook for the ice trade is better than last year, and if the meeting of the ice exchange is a success next month, so we have a large attendance, no doubt the ice trade will be better than last year.

Nashville.—Howe Ice Co.: Wholesale rates, packed any quantity, 50 per cwt.; in car, loose, less than 5 tons, $6 per ton; 5 to 12 tons, $5; 12 tons and over, $4.50; retail, 100 lbs. at one delivery, 40c.; 50 lbs., 25c.; 25 lbs., 15c.; 16 lbs., 10c.; 8 lbs., 5c.

Meadows & Osgood [Wholesale f. o. b. and retail list same as quoted for Howe Ice Co.—ED.]: Delivered in city limits: 1,000 lbs., one delivery, $7; 2,000 lbs., $6; 5-ton lots, $5; prices at factory, 600 lbs. or more at one time, per ton, $6; 2,000 lbs. or more, $5; retail at factory, 100 lbs. or more, 35c. per cwt.

TEXAS.

El Paso.—El Paso Ice and Refrigerating Co.: It would give us pleasure to quote you prices for ice during the coming season, but so far none have been established. Should matters adjust themselves on a business basis, so that the outlook for permanency is encouraging, we will take pleasure in advising you. No natural ice was harvested here, but there was some at Las Vegas, and, we understand, of good thickness, but as to its quality we are not prepared to speak. We understand that from 8,000 to 10,000 tons were housed.

Palestine.—Palestine Ice Co.: We quote the following prices per cwt., delivered, subject to change later in the season: Lots of 5 lbs., $1; 10 to 50 lbs., 75c.; 50 lbs. or more, 50c.; to butchers, at factory, 40c.

Paris.—Paris Ice Co.: Our price list this season is the same as last—50c. per cwt. to saloons, hotels and butchers; to families, 75c. and $1 per cwt., where it is delivered in small quantities. Our price per car load is $6 per ton f. o. b. car. There was no natural ice harvested in this country, and machine ice does not have to come in competition with lake ice. The outlook is good in north Texas for a healthy and prosperous trade this season.

Waco.—Waco Ice and Refrigerating Co.: Our prices on manufactured ice this season are as follows: In car load lots of not less than 15 tons each, $3.75 f. o. b. our track; in quantities delivered in city twice a day, 35c. per cwt.; family trade delivered in city twice a day, 50c. per cwt.; in sacks for express shipments, 50c. per sack of 100 lbs. f. o. b. here. We know of no natural ice in any quantity harvested south of Hannibal, Mo. The prospects for the legitimate ice manufacturer this season are not bright. This is on account of the methods of some of our great brewers in their greed for Texas territory.

VIRGINIA.

Graham.—Mitchell Transparent Ice Co.: The following are our prices per ton for last season, and we see no reason why they should be changed: In car load lots, $5; 1-ton lots, $6; ½-ton lots, $8; 100-lb. lots, $10. One hundred lbs. is the smallest quantity we sell. These prices may seem a little high at first sight, but, being 2,500 feet above the level of the sea, the ice season is very short, and we can only run about five months in the year; so we have to "make hay while the sun shines." This year we expect the largest sales we have ever had, as the winter has been unprecedentedly warm, and there has not been a pound of ice put up within a radius of 150 miles. It will always give me great pleasure to add my mite to the usefulness of your very excellent journal.

Hampton.—Chesapeake Light and Power Co.: Our price for ice the coming season will be the same it was last, viz.: $4.50 per ton at plant wholesale, and $5 per ton delivered in town; 40c. per cwt. delivered, and ½c. per pound delivered in less than 100-lb. lots delivered to houses. All of the natural ice sold here comes from Maine, and no other was sold here before we commenced making; previous to our commencement ice retailed from 75c. to $1.25 per cwt. The season commenced in May and closed in October. We fixed the price of ice delivered to houses at ½c. per pound. The result has been that everybody takes ice, and we, as well as the natural ice dealers, have had to run wagons all the winter, instead of lying idle six months of the year. We have built an ice house, and will make in the winter and store for summer market, which will save increasing our ice machinery. We have had no fight with the natural ice dealers, as we do not believe in cutting the prices down to starvation rates. We find the most intelligent people prefer the manufactured ice.

Richmond. Crystal Ice Co.: Our prices for the coming season will be the same as for the past four seasons during which we have been in business, viz.: For family trade, in lots of less than 100 lbs., ½c. per lb.; in lots of from 100 lbs. to 1,000 lbs., 40c. per cwt.; 1,000 lbs. to 2,000 lbs., 30c.; 2,000 lbs. and over, 25c.; 12 tons and over, $4 per ton f. o. b. cars, or in house. The prices for family trade are too low, but competition is the cause. Dealers will not "pull together," and the consumer gets most of the benefit of the season's business. Some dealers here sell for much less than above prices, but they do not give good service, which costs money, and cannot be relied on to furnish ice in very hot weather. We have built up a good trade by having a uniform price each year, and by giving prompt service and good weights, and ice cannot be sold cheaper here at a profit, as the season is short and whatever profit is made must be made in six months, after which business must be done the rest of the year

at a loss. No natural ice has been harvested in this state during the past winter, but the natural ice dealers here always get their ice from Maine. Country ice, when there is any, is sold only to ice cream makers and fish dealers, and at a very low price. Prospects for profits are not encouraging if we have to meet the competition of new men who have no idea of the cost of delivery and are trying to sell at 25c. per 100 lbs. delivered in small quantities, ice for which they pay at the factory $2.50 per ton, and have to haul about two miles. It costs us during twelve months' work $2.57 per ton to deliver ice in the city.

WEST VIRGINIA.

Wheeling.—Schmulbach Brewing Co.: There was very little natural ice stored away here, as it did not average over five inches. Some of the butchers stored what little was put away. As to prices here, ice is being sold at $4 per ton in small lots, and at 25c. per cwt., with prospects of higher prices in the summer.

CONNECTICUT ICE DEALERS.

THE sixth annual convention of the Connecticut Ice Dealers' Association was held at Waterbury on March 22. Vice-President E. A. Upson of that city presided. Sixty delegates were present.

The following officers were elected for the ensuing year: President, E. A. Upson, of Bridgeport, one of the best known ice men in New England, being secretary of the Hall & Upson Co., Waterbury, secretary and treasurer of the Naugatuck Ice Co., Bridgeport; president of the Ansonia Ice Co., and president of the Meriden Ice Co.; vice-president, John S. Castle, Waterbury; secretary, F. F. Bishop, New Haven; treasurer, W. M. Charter, Hartford.

No schedule of prices was decided upon, for after much discussion it was decided that to impose a uniform rate would admit of difficulties, and the matter was left to local action.

For every year since the organization of the Association (1889) the late W. P. Rogers, of New London, had been president. He had been in the ice business for forty years, and suitable resolutions on his death were adopted at this meeting.

A committee on insurance reported on progress in regard to lower rates of insurance on ice houses. There was also an informal talk on automatic machines for raising and lowering ice and on other devices for economical cutting and housing of ice. There was also a discussion on the methods of artificial ice making.

At 2:10 P. M. the party adjourned for the annual dinner. Those present included: L. A. Granniss, A. H. Mix, L. Mead, W. W. Ward, W. E. Miller, Burton Dickerman, J. T. Newton, F. F. Bishop, New Haven; J. P. Curtis, F. E. Rhodes, New Britain; M. G. Grant, Naugatuck; W. E. Norton, Bristol; Albert A. Betts, F. H. Merrill, Norwalk; S. J. Ferris, New Milford; Robert Smith, New Hartford; William J. Munson, Watertown; Henry G. Wheeler, W. E. Peck, Stratford; Joseph Brazos, Middletown; Herbert B. Sherwood, Southport; G. G. Watson, Shelton; Lloyd Nash, Westport; W. R. Perry, New London; M. H. Belknap, Ansonia; E. A. Upson, W. W. Watson, Bridgeport; W. W. Taintor, Hartford; C. E. Seaman, South Manchester; John Maher, Greenwich; P. C. Hammond, Stamford; Charles I. Foster and George A. Foster, Meriden; J. B. Mullings, Charles R. Vaill, John S. Castle, William E. Austin, J. H. Somers, F. W. Lockhart and Nelson Hall, Waterbury.

—The following breweries have recently put in refrigerating machines built by the C. G. Mayer Ice Machine Co., 744 Broadway, New York: W. P. Deppen, Reading, Pa., 35-ton; Geo. Wiedenmayer, Newark, N. J. (second order), 50-ton; Franz X. Hoser, Chester, Pa., 35-ton.

[*Compiled for* ICE AND REFRIGERATION.]

THE ICE HARVEST.

GENERAL BRIEF REVIEW OF THE RESULTS OF THE ICE HARVEST.—CROP AS A WHOLE IS SHORT.—GLEANINGS FROM OUR CORRESPONDENCE.

THE crop of ice for 1894 is now in the house, and as a whole may be set down as a short crop. Those states lying along the great lakes on Canadian border, except Illinois, Indiana, Ohio and Pennsylvania, have had a very satisfactory season so far as results are concerned, though full of uncertainties. New York state, the Hudson river territory, New England and Maine have ample supplies, though in no case is there a full crop except in Maine. In the central part of the country and the south, no ice, or very little ice, was housed, and that part of the country will have to depend on the machine or draw supplies from Wisconsin, Michigan, northern New England and Maine.

A CAREFUL estimate of the amount of ice harvested this winter on the Kennebec river puts the figure at 850,000 tons, which, with the amount carried over from last season, estimated at 400,000 tons, makes a total of 1,250-000 tons. About all of this is held by companies which have a regular market in the large cities, only two concerns having what may be called speculative ice. Holders think that there is no reason to doubt that every block will be shipped. This ice is all of the finest quality. On the Penobscot the cut is estimated at 144,000 tons of new ice, which, with 140,000 held over, makes 284,000 tons available there, all from twelve to eighteen inches thick and very good quality. There is already some talk of an advance of freight rates, however, which may perhaps interfere with the free movement of the ice.

THE Hudson river crop is neither as large nor as good as usual, perhaps, not comparable, certainly, with that of a year ago; nevertheless there does not appear to be any serious shortage, if there is indeed any shortage there. The cutting has been irregular through interruptions by thaws, but it may be said that with the ice held over from a year ago, the houses hold enough to meet the average demand anticipated from year to year. There is at least no fear of an ice famine. Dealers in Albany and Troy have made their usual harvest, while down the river the work of filling the houses belonging to the large companies was rapidly pushed whenever opportunity offered; so that taking all in all the river crop is a most favorable one.

GLEANINGS FROM CORRESPONDENCE.

Bridgeport, Conn.—The Naugatuck Valley Ice Co. report as follows, March 21: The majority of the dealers in Connecticut, we believe, have secured a full supply, although in the shore towns the season for cutting was very short, and the ice would not have been gathered had we not worked night and day. The ice is not all of first-class quality, on account of the unusual amount of snow we had, but will average from 9 to 11 inches thick, and as in our Bridgeport houses we plane all the ice on the elevator, we have gotten rid of most of the snow. At our houses in Waterbury, Ansonia and Meriden we have a [illegible]

supply, and the prices in those cities will remain the same as last season.

Hamilton, Ont., Canada.—J. D. Evans: The storage of ice supplies this winter have been short of usual quantity housed, and the quality is only fair, with about 20,000 tons stored (not including the brewers and pork factories, who simply store for cooling purposes).

Ottawa, Ont., Canada.—Independent Ice Co.: We have about 8,000 tons of ice stored up for the season 1894. In all there is stored up about 20,000 tons of ice in this city. The natural ice crop this winter was first-class; ice about 25 inches thick, clear and solid, and the second crop was 18 inches thick and good ice. The weather was very favorable for harvesting clear, bright and cold, and the prospects for this season are splendid, orders coming in quite freely even at this early period.

Cairo, Ill.—Distilled Water Ice Co.: No natural ice housed in southern Illinois.

East St. Louis, Ill.—G. A. Peck: There was no ice stored here this winter.

Springfield, Ill.—Pure Ice and Cold Storage Co.: The stocks of ice are much smaller in the city than usual. There was no ice for commercial use in this immediate vicinity fit to pack, the heavy drifting snow following the only cold spell we had, having ruined it. There were a few hundred tons put up for slaughter houses, etc. The Illinois river points also have but a partial supply, and that also is snowy. Moline being the nearest shipping point, has made the stock cost fully $1 per ton above last year's price. The brewery here (F. Reisch & Bro.) has just completed a machine for ice making, put in by the Frick Co., of Waynesboro, Pa., who put in a 50-ton machine for refrigeration for same firm several years ago. They start on a thirty-day test, April 1, and expect about 20 tons daily. We are storing only about 300 tons of ice, part in sawdust and part in cold storage room.

Indianapolis.—Journal, February 19: The ice dealers are discouraged at the outlook for natural ice for the local houses this year. There is a small per cent of ice cut in the winter of 1893 yet in the local houses, but it would not supply the market two weeks. Some of the dealers in natural ice are arranging to ship in from the north, but it is quite evident that the manufacturers of artificial ice are to control the market the coming summer. Therefore the manufacturing capacity of the local plants becomes of interest. There are now three good plants in operation, which have a capacity of 85 tons a day, and a new plant is nearing completion which will have a capacity of 40 tons a day. One of the ice manufacturers is to put in additional equipment, which will increase the plant's capacity 20 tons, so that the four artificial ice plants will have a capacity of turning out 145 tons a day. In three cases the total output of the artificial ice plants has been practically contracted for, and as the new plant belongs to one of the ice companies, a half dozen ice firms will have to secure their supply from other points. The daily consumption is placed at 200 tons.

Burlington, Iowa.—M. Dunn & Co. report, March 20: The past winter was not a favorable one for harvesting ice at this point. No cutting was done here until the last week in January, and this run only lasted five or six days. Cutting was resumed about February 20, and continued for nearly two weeks. During this time a fair supply was harvested under many difficulties, as only those who have had experience in cutting ice of the Mississippi river know. About 20,000 tons for all purposes was packed. Less than one-half of this is for domestic use; the balance is packed in cold storage houses, butchers' houses, etc. The dealers here are confident that with only this small supply in sight they will be able to maintain prices, and still their customers will have no reason to complain. One house of 5,000 tons packed the previous winter has been sold at $1.15 per ton to St. Louis parties. Two other houses of 3,000 tons are held for sale to be shipped. The northern roads carried through here for St. Louis some 300 cars, and about 200 cars were loaded at this place for the same market. Late in the cutting season there was quite a demand from neighboring towns for car loads of ice, which could only be partially supplied. The crop south and west from this point must have been very short.

Davenport, Iowa.—J. B. Phillips: The natural ice harvest in this city was deficient, both in quantity and quality—not more than one-half as much was secured this season as last and what was secured was only 7 to 9 inches thick and is of poor quality, having been stored during warm weather chiefly and being from sloughs and ponds. No channel ice was secured. Prices, however, are but slightly advanced.

Des Moines, Iowa.—H. E. Teachout: The ice companies here secured their storage capacity and I expect there will be enough to meet the requirements. The natural ice is somewhat speckled with soot from the city, as it always is when we have a warm winter. It seems to me it would be a good plan for an ice dealers' convention to be called in order that the different views of each other might be learned as to the best way to conduct the business and a uniform system adopted.

Fort Madison, Iowa.—F. C. Schaper: There were about 10,000 tons of ice harvested here this winter and about a one-third crop was left from last season. Besides this, there were about 10,000 tons put up in cars and shipped south. There was no good ice to be had before the 5th of February when it was nice, clear ice from 7 to 12 inches thick.

Wichita, Kan.—Crystal Ice Co.: There has been put up of natural ice about 3,000 tons, 6 inches thick, a part of this not of good quality.

Winfield, Kan.—C. M. Gay: As regards natural ice crop, it has been very light in southern Kansas. Very little ice was stored except for packing, and that consists mainly of 3 to 4 inches of Kansas wind with enough frost around it to hold it together long enough to store.

Louisville, Ky.—Pictet S. W. Ice Co.: There was no natural ice gathered in this vicinity, as it only reached 3¾ inches in thickness.

Baltimore, Md.—Biemiller Ice Co.: There has been no ice cut the past winter in this vicinity for the trade, and all the ice (natural) used here will have to be shipped from Maine. All the natural ice dealers here will, therefore, be on an equal footing, there being no surplus from last season.

North Adams, Mass.—John J. Marsh: Most of the ice put up in North Adams is of fair quality, from 8 to 10 inches thick, and about the same in Adams.

Marquette, Mich.—Journal, March 5: A full crop of most excellent ice has been harvested.

Detroit, Mich.—Tribune, February 24: Chas. A. Dean says: "We have at present 30,000 tons gathered, and with proper weather will have our usual supply, 60,000 tons, all in by the middle of next week." Houghton, French & Co. have nearly their full supply, 30,000 tons in their houses on the river, and 5,000 tons at Orion. Wirth & Winch say that their houses are about two-thirds filled, but it is only a matter of a few days when they will have 25,000 tons.

Duluth, Minn.—Duluth Ice Co.: There is in store at this point 20,000 tons belonging to ice dealers. It is of fine quality, mostly taken from Lake Superior, and from 12 to 18 inches thick.

Kansas City, Mo.—Kansas City Ice and Cold Storage Co.: In regard to natural ice, would say there were probably in the neighborhood of 30,000 tons put away in this vicinity. This ice is from 6 to 7 inches thick. There was some ice kept over from last season.

St. Louis, Mo.—Creve Cœur Lake Ice Co., March 16: "No ice was cut in this locality this winter, and very little within 200 miles from here. There was considerable old ice carried over from 1893 crop, that along with the artificial ice will about take care of the St. Louis market the coming season. There have been no standard prices made yet, either wholesale or retail, but indications point toward low prices. However, a warm summer will bring prices to a reasonable basis." The St. Louis Ice Mfg. and C. S. Co., same date, writes: "We understand that there is a moderate amount of old ice carried over from last year. The crop of natural ice is short within a radius of 300 miles from St. Louis, the general quality of the ice being much poorer than last year. It is thin and was frozen in snow, thereby causing the ice to check badly, hence the shrinkage will be very great. Machine ice is being used in preference to the natural ice when the consumers understand the difference in the quality of water that makes the ice."

Springfield, Mo.—Springfield Ice and Refg. Co.: There was no natural ice harvested in this section last winter.

Lincoln, Neb.—Lincoln Ice Co.: The amount of ice stored is somewhat greater than usual, and quality rather above the average, running from 10 to 18 inches.

Holly Beach, N. J.—F. E. Smith: There was no ice harvested within 100 miles of here that amounts to anything.

Little Falls, N. Y.—Little Falls Warehousing Co.: The crop of natural ice in this section was plentiful; quality good, but the harvesting season was short; about the usual quantity was harvested.

Utica, N. Y.—Utica Cold Storage and Warehouse Co.: We find on inquiry that there has been about 40,000 tons of ice stored by dealers and others, which is a full crop. The quality of same is fair, the ice being of usual thickness, but somewhat porous.

Cleveland, Ohio.—Cleveland Ice and Refrigerating Co.: As regards the harvest of natural ice in our immediate vicinity, it has been very small, and hardly think that there has been much if any over 10,000 tons put up for use in this market. The above we think is a fair figure, but may vary either way.

Marion, Ohio.—Marion Ice & C. S. Co.: No natural ice of any consequence was housed here. Private parties housed some 4-inch to 6-inch ice of poor quality, for their own use. The natural ice dealers will ship all they use from the lakes.

Portsmouth, Ohio.—J. Esselborn: There has been no natural ice to speak of in this neighborhood. In the ponds and canal basin, ice not over 5 inches thick was harvested, and only little of that was put away. What other ice comes here, besides what we manufacture, comes from the lakes. From the lakes the freight rate makes ice cost, even in cold winters, from $1.75 to $2.25 per ton. The ice factories, since the ice famine of 1891, have been built all around here, so that ice famines are a thing of the past. Such prices as $4 or even $6 per ton seem all *ausgespielt*.

Altoona, Pa.—Pennsylvania Ice Co.: The natural ice harvest in this region was very poor indeed; but owing to the existing stringency of the money market and general business, we

have made no advance whatever in our price for manufactured or natural ice, feeling that the trade deserves this action on our part.

Wilkes Barre, Pa.—The ice harvest was perhaps half a crop on the mountain lakes and streams, but there was none in the valleys. On natural ice people got all they wanted of 10-inch ice, but not of first quality. I cannot estimate the harvest in tons.

Rhode Island.—Lee Earl Carpenter & Sons report under heading of prices.

NATURAL ICE NOTES.

——Ed. Starr has leased the Abbott ice house at Morris, Ill.

——St. Paul uses 120,000 tons of ice per annum, and has a full crop.

——The Minneapolis Brewing Co. will build a depot at Winona, Minn.

——The harvest at Pekin, Ill., usually very large, was only a partial success this year.

——Erie, Pa., has housed enough 4-in. to 8-in. ice to carry the trade through the season.

——The Washington Ice Co. is adding two more rooms to the house at Watertown, Wis.

——Thomas Brasier contemplates building a 20,000-ton ice house at Athens, N. Y., next summer.

——The North-Western road cut ice at Blount, S. D., taking out 250 cars at a cost of 35c. per ton f. o. b.

——Cincinnati's crop is no less than 30,000 tons short, counting the product of the machines as ice in store.

——The Allerton packing house at Chicago has shut down, throwing 300 men out of work; cause, high price of hogs.

——The Dotter Ice Co., Cohoes, N. Y., has sold its stock of ice to New York parties, shipments to be made by river.

——T. Connor and J. Riley have leased an ice house at Waldron, Ill., and will go into the retail business next summer.

——The natural ice crop for Indianapolis is a failure, less than one-third of a crop having been housed, and this ice poor.

——J. & H. C. Milless and F. Schroeder have formed a partnership to conduct a retail ice business at Hammond, Ind.

——J. N. Taylor, ice dealer at Sharon, Pa., has contracted for supplies from the New Castle factory, to be retailed at old prices for natural ice.

——The Rockport (Me.) Ice Co., by March 20, had shipped this season, direct from the water, 25,000 tons of ice, the largest amount ever shipped in any season before.

——The Consumers' Ice Co. is a new incorporation at Sandusky, Ohio, in which both C. L. Wagner and Leser & Dewit are interested. The capital stock is $10,000.

——The new Knickerbocker Ice Co., Toledo, with capital of $100,000, is soliciting stock subscriptions among consumers, no one person being allowed to exceed ten shares ($100) of stock. The company guarantees ice to its own stockholders first, and shareholders will also be entitled to all rights and privileges of hunting and fishing on and around Gard island, which has been purchased by the company, with all the plant and ice houses and club houses upon it. This island contains 28.66 acres of land, and its owners have riparian rights over the two channels, representing about 2,000 acres of marsh and fishing grounds. The incorporators of the Knickerbocker Ice Co. are M. I. Wilcox, Franklin Hubbard, L. F. Lytle, J. L. Wolcott and E. W. Baumgardner; the officers are: President, V. H. Ketcham; vice-president, Chas. Hanner; treasurer, Sam A. Hunter; secretary, W. L. Hoyt, and the directors are these officers and Richard Waite, Jacob Kurtz, A. J. Scott, Charles Gatesman, Milton Taylor, P. B. Thomas and O. B. Snider.

——*New Ice Houses.*—Erected by H. S. Tabor, Warsaw, N. Y.; Andrew Wilcox, West Troy, N. Y.; Luther Kilbourne, Southwest Hudson, near Akron, Ohio; James Rayl, Maple Rock, near Painesville, Ohio; W. H. Smith, Carroll, Iowa; Buer & Mortenson, Scandanavia, Wis.; C. & A. R. R. Co., Bloomington, Ill.; Geo. Comstock, Riverside, near Brockville, Ont., Canada; Mr. Anable, Grand Blanc, Mich.; Frank Whitfield, Pontiac, Mich.; Mill Plain Ice Co., Wolcott, Conn.; Wilson Moulton, West Campton, N. H.; Lester Ballard, New Salem, Mass.; Lincoln Ice Co. (Chicago), McFarland, Wis.; Wm. M. Moulton, West Campton, N. H.; Flagg & Bartlett, Abington, Mass.; A. H. Orkins, Ludlow, Vt.; H. S. Tabor, Warsaw, N. Y.; John Gallagher, W. Madison, Wis.; H. J. Harp & Son (addition), Green Island, Troy, N. Y.; C. Billman, Cedar, near Traverse City, Mich.; Geo. Staiger, Leavenworth, Kan. (addition); Wm. J. Iseman, Hunt's, near Danville, N. Y.; Stowell & Webb, of Drayton, Mich., at Pontiac, Mich.; Goos & Weber, Norwich, Conn.

——*Stocks Housed.*—B. Cooper & Co., Troy, N. Y., 60,000 tons; A. Wilcox, West Troy, N. Y., 15,000 tons; dealers at Albany, N. Y., 65,000 tons; Twin City Ice Co., Rock Island, Ill., 25,000 tons; Riverside Ice Co., Quincy, Ill., 14,000 tons or one-third of a crop; J. F. Winkler, Saginaw, Mich., 16,000 tons; O. M. Mowry, Manville, R. I., 15,000 tons; houses at "Lake Sixteen," near Huntington, Ind., 70,000 tons; Pawtucket (R. I.) Ice Co., 16,000 tons, a shortage of 4,000 tons; Burlington, Iowa, dealers, 6,000 tons, not including private stock for liquor coolers and poultry dealers' houses; Geo. H. Miller, Woonsocket, R. I., 9,000 tons; Utica, N. Y., dealers, 75,000 tons; Kalamazoo (Mich.) Ice Co., 10,000 tons: East Providence (R. I.) Ice Co., 35,000 tons; shippers at Beardstown, Ill., 15,000 tons about, not including shipments made during the harvest season; Compton & Cook, New Castle, Ind., 1,000 tons; cut from Cazenovia lake, Brookfield, N. Y., 100,000 tons; dealers at Detroit, about 125,000 tons; Doyle & O'Hare, Flint, Mich., 15,000 tons; Dick Bros. Brewing Co., Quincy, Ill., 6,000 tons; J. E. Reau, Marquette, Mich., 2,500 tons; Sanderson & Son, Ottawa, Ill., 11,000 tons; Lynch & Glover, same place, 7,000 tons; dealers at Crystal lakes and Lake Geneva, Wis., 100,000 tons; Elmira (N. Y.) Ice Co., 12,000 at South Bay; E. V. Hangsterfer, Ann Arbor, Mich., 15,000 tons; H. W. Davis, Lapeer, Mich., 25,000 tons; at Williams Bay, Wis., 40,000 tons; Pottstown (Pa.) Ice Co., Frank K. Pennypacker, proprietor, 6,200 tons; Johnson Ice Co., Jamestown, N. Y., 9,000 tons; Leach & Co., Kokomo, Ind., 800 tons; Hartford (Conn.) Ice Co., 10,000 tons, two-thirds of a crop; Spring Brook Ice Co., Hartford, Conn., 11,000 tons; L. S. Main, Hartford, Conn., 2,000 tons, about one-fourth of a crop; Ionia (Mich.) Ice Co., 4,000 tons; Carpenter Co., Providence, R. I., at their Mashapaug houses, 2,500 tons, which is only a nominal cut; Independent Ice Co., of Boston, at Mirror lake, Marlboro, Mass., 35,000 tons; Holyoke and South Hadley Falls Ice Co., Springfield, Mass., 15,000 tons; Consumers' Ice Co., Albany, N. Y., 6,000 tons; cut at Pembina, N. D., 50,000 tons; N. Y. Central railroad at Horseshoe pond, near Troy, 25,000 tons; cut at Pewaukee, Wis., 225,000 tons for Chicago packers and Milwaukee ice dealers; John Hilt Ice Co., La Porte, Ind., 30,000 tons; Cedar Lake Ice Co., Minneapolis, 60,000 tons.

FIRE AND ACCIDENT RECORD.

——Sam'l Weider's cold storage at Cochranton, near Meadville, Pa., was burned March 2; loss not reported.

——The Queen City Ice Co.'s stables, at Buffalo, N. Y., were burned March 10; loss, $1,500; insurance, $1,000; cause, unknown; no horses lost.

——The cold storage house at Omaha, operated by Mullin & McClain, was burned March 16. The damage amounted to nearly $100,000; insured.

——The Wilmington (Del.) Abattoir and Cold Storage Co.'s plant was damaged by fire March 10; the insurance companies were assessed 25 per cent of their risks to cover the loss.

——Three floors of the ice house, Chicago, of P. H. Noonan's packing house, fell March 1. Three men were seriously hurt, employes of T. W. Zuttermeyer, who was filling the ice house.

——The cold storage and commission house of F. R. Simmons, Erie, Pa., was badly wrecked March 13 by the explosion of a tallow rendering vat. The building, 70×40 feet, and three stories high, was wrecked and almost entirely destroyed.

——Barney Mooney, foreman of a gang of ice cutters at Waterloo, near Hackettston, N. J., was decapitated February 24. The steam elevator dumper got out of order, and Mooney went underneath to readjust it. The men assisting him, after attending to the readjustment, stepped out, and, supposing everything all right, started the dumper. It caught Mooney by the head and actually pulled the head from the body. He was fifty years of age, and left a large family.

——Geo. Davis, Washington, Pa., is in the market for 1,000 tons of ice.

——Wheeler & Son have sold their ice business at Troy, N. Y., to B. Cooper & Co.

——The York Manufacturing Co., York, Pa., sold an ice machine to Alta, Mulholland & Co., Philadelphia.

——Henry Burkhart, of Dayton, Ohio, has bought a 40-ton Sulzer-Vogt refrigerating machine to use in his butcher shop.

——The Western Union Cold Storage Co., with capital of $500,000, has been incorporated, having for its object the leasing of the chief Chicago down-town cold storage houses. J. J. P. Odell, president of the Union National bank and of the Union Cold Storage Co., is to be president of the new company, which is to include in its management the Produce Cold Storage Exchange, of which George M. Moulton is president, and the Western Refrigerating Co., of which Edward P. Baker is the president. The plant of the Union is said to be worth $600,000, while that of the Produce Exchange is worth $700,000. Mr. Baker's company has the largest plant, said to be worth $1,000,000. The new company will lease these plants for a term of years. The Water street merchants profess to see in this consolidation a threat at their interests; but it is much more likely that the truth is that the idea of combining the three companies is to put a stop to the advancing of money to produce merchants and egg shippers. Each company has been vying with the other to induce South Water street merchants to deal with it, out of which has grown the custom of lending money on produce to the merchants, and the company most ready to do this would naturally get the business. In this way the cold storage men have actually furnished the working capital for many produce men, as well as that of egg buyers all over the west from Chicago to Denver. The system has become top-heavy and the combination may bring the custom within something like manageable bounds. And looking at the recent behavior of the egg market, one would say it is about time. The cold storage department of the Consumers' Pure Ice Co., Thirty-fifth and Butler streets, is, of course, outside this deal.

ANSWERS TO CORRESPONDENTS.

THE AMMONIA CHARGE—MENDING PIPE, WASTE OF AMMONIA, SCALING OF PIPES AT WATER LINE OF THE TANK—CALCULATING CAPACITY—LIFTING AMMONIA.

[This department of ICE AND REFRIGERATION is conducted for the benefit of the trade generally, as well as individuals; and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

THE AMMONIA CHARGE.

To the Editor: As a reader of your valuable paper, I take the liberty of asking you a question: (1) I have a compression machine, cylinder 6×14 inches, single-acting. (2) I have 832 feet lineal of 2-inch common pipe in my expansion coils. Now my question:—How many pounds of ammonia do I need to charge my machine? J. R. H.

ANSWER.—As you do not give the number of revolutions and other information, it is difficult to arrive at the capacity of your machine from the first item. In accordance with the second item which you give, viz., 832 feet 2-inch expansion coils, we judge that your plant is calculated to represent a capacity of about ten tons, and therefore conclude that from 150 to 200 pounds of anhydrous ammonia will be what is needed to charge the same.

MENDING PIPES, WASTE OF AMMONIA, ETC.

To the Editor: What (1) is the usual quantity of ammonia that is required to be added each year, say ten months' run, for a machine of twenty tons capacity? Also, what (2) is the best way to mend the coils that sometimes split in the bath? Also (3) coils that split or burst in condenser and cooler? Is there (4) any preparation that will keep the pipes from scaling when they enter the water, where they are exposed to both air and water? J. B. H.

ANSWER.—(1) "The amount of ammonia needed depends almost exclusively upon the care and watchfulness of the engineer in charge of the machine. We, however, have personal knowledge of three different plants as to the cost per ton of ammonia and every other item of expense for the entire year, as follows: The cost of ammonia on a 40-ton plant was 8⅔c. per ton of ice made; the cost of ammonia on a 25-ton plant was 4½c. per ton of ice, and the cost of same on 55-ton plant was 7.08c. per ton of ice. The reason that the cost of ammonia in the larger machines was more than the 25-ton machine was on account of joints blowing out." In accordance with the above figures, which were given us by a manufacturing firm, the cost for ammonia for a 20-ton machine would be about $180 per year. Others place the loss of ammonia at a much lower rate, claiming that about $50 should cover this loss, on an average for a year. Instances are cited in which no ammonia was added during a period of two years, in compression machines. (2 and 3) The easiest way to mend splits or cracks in pipes is by soldering them with tin solder. The Consumers' Ice Co., of San Francisco, suggests the following as a very successful way of mending coils: "Litharge: make same into a stiff paste by mixing glycerine; close split; cover well with mixture; cover this with $\frac{1}{16}$-inch thick sheet rubber; cover this with a strip of galvanized charcoal iron, say $\frac{3}{16}$-inch thick by 1 inch wide (length to suit); fasten to pipe with $\frac{5}{16}$-inch axle clips (and in length to conform to size of pipe) with wrought yokes, one clip for short split, and so on. The galvanized iron strips can be got ready in lots of different lengths and shaped to the pipes. The repairing is very expeditious and effective. We find a thin coat of P. & B. paint very beneficial." (4) To protect the pipes against scaling off, we think that a good iron varnish, renewed from time to time whenever necessary, is about as good a remedy as any. [See also ICE AND REFRIGERATION, February issue, page 103, second paragraph of second column.]

CALCULATING CAPACITY, ETC.

To the Editor: (1) Do you know of any work on refrigeration that will post me on figuring the capacity of machines on all classes of work? (2) I would like to have you explain one part of the formula for obtaining capacity of machine, given on page 108 of the February issue. You say, thus:

$$\frac{23,000 \times 50}{284,000} = 4.05 \text{ tons capacity necessary}$$

to cool this room. You then say—

$$\frac{44,000 \times 0.7 \times 50}{284,000} = 5.4 \text{ tons.}$$

Why do you use 50 the second time? In your first formula you obtained the necessary capacity to cool the room alone. In the second, it seems that by using 50 the second time you are also doing the same thing. And then when you add the two results you have a larger machine than is needed. W.N.L.

ANSWER.—(1) We do not know of any book that will give just what you want in the way of calculations, etc. The only book of probable use is "Ice Making Machines," by Ledoux, published by D. Van Nostrand Co., of New York. (2) As to the factor 50 used in both formulæ, it has an entirely different meaning in each case. In the first formula this factor signifies that about fifty units of heat must be abstracted for every ten cubic feet of space in twenty-four hours in order to keep the space and contents at the temperature of 30°, or thereabouts, and the elaboration of the first formula gives this for a space of 230,000 cubic feet approximately. By the elaboration of the second formula, however, we find the amount of heat that must be abstracted from 44,000 pounds of heat, etc., to cool it down from 80° to 30°. The difference between 80 and 30 being 50, it follows that 50 units will be needed to cool down one pound of meat, and hence the use of the same factor 50 in the second formula, although with an entirely different meaning.

LIFTING AMMONIA.

To the Editor: Where ammonia is discharged from the top of the condenser, instead of at the bottom, is not unnecessary work required to raise the weight of the liquid ammonia? And might it not be overcome by passing the ammonia through the condenser in the opposite direction, discharging it at the bottom? C. A. D.

ANSWER.—The weight of ammonia handled by the compressor is the same whether in the form of gas or liquid, and the same amount of work is required to pass it through the condenser whether it be introduced at the top or at the bottom. Some difference might be perceived if the pipes were of very small diameter, but in common practice no work is lost on account of the particular point on the condenser from which the liquid ammonia is discharged.

SUPERHEATING STEAM FOR BOILING KETTLES.

To the Editor: Is there any way by which I can superheat the exhaust steam from my engines and use it for boiling the kettles in the brewery? I think if I could raise the temperature to that of live steam, the boiling could be done much more economically and with less trouble. If there is any practical plan for the purpose that is not too expensive to install, I wish you would give me more information regarding the same. C. M.

ANSWER.—There are several devices, in the way of economizers and reheaters, that are employed for raising the temperature of feed water, and of steam also, by utilizing the heat of the waste gases from the furnace, but the methods are generally expensive to install,

requiring, as they do, a comparatively large space, and such frequent scraping to preserve their efficiency that we could not recommend them for the purpose you suggest. We cannot tell, without further information, whether the exhaust steam would be sufficient for the purpose. If not, you understand that you would have to use some live steam, and would require reducing valves and other devices and changes that would make the adoption of a plan of superheating steam somewhat costly in a plant already established. The amount of steam required at boiler pressure and temperature to boil a kettle of beer is usually more than would be supplied by the exhaust from the engines. Superheating devices have never met with much favor in steam plants, as they deteriorate rapidly, and unless properly managed do not serve the purpose for which they were intended. Something on the same principle works very well for heating feed water, and is said to produce considerable economy in the majority of the plants in which it is installed; but heating water and superheating steam require different conditions and management. To get some practical figures on the subject, you might attach a water meter to the drip connected with the steam jacketed kettle and ascertain the weight of steam condensed during a single boiling. This would give one point required in making the calculation. An indicator diagram from the engine would furnish means for ascertaining the weight of steam which could be obtained for superheating. The location of the kettles in the plant, the distance from the boiler, the possible location of the superheater and such points might be ascertained as a basis for calculating what work could be obtained from and the probable cost of superheating the exhaust steam.

NEW COLD STORAGE PLANTS.

THE building season is fairly on, and the new work on this line quite keeps pace with that in ice factory building. Increase of the smaller plants is noticeable, though some big city plants are being enlarged. The record of work is as follows:

CALIFORNIA.

Los Angeles.—Westinghouse, Church, Kerr & Co. (Chicago office), have sold a small refrigerating machine to Louis Streuber, of this city.

CONNECTICUT.

Hartford.—Geo. Goyt is putting in a Remington refrigerating machine, built by the Remington Machine Co. The power will be supplied by electric motor.

ILLINOIS.

Chicago.—Albert W. Cobb & Co., commission merchants, 41 River street, have bought a small refrigerating machine for use in their business premises, of Westinghouse, Church, Kerr & Co. (Chicago office).

Dundee.—The milk condensing company is building a cold storage house.

Ottawa.—Alfred White, the brewer, has bought a 10-ton Hercules refrigerating machine to be erected at once. In addition to refrigerating his brewery, the machine will be made to cool sixteen to twenty cold storage chambers, to be rented to the local merchants, etc.

IOWA.

Carroll.—W. H. Smith is building a cold storage house.

Fort Dodge.—M. M. Walker & Co., fruit commission, of Dubuque, will put up a cold storage house here.

LOUISIANA.

Donaldsonville.—The Donaldsonville Ice Co. will probably enlarge the cold storage capacity of their plant.

MASSACHUSETTS.

Newton Centre.—Mellen Bray will add twenty-five feet to his new power house to furnish power for a cold storage plant.

MICHIGAN.

Saginaw.—King & Moore have begun work on a new cold storage building for their own use on their property on North Jefferson avenue. This building will be three stories in height and 50×60 feet in area. We are told by the local paper that "there will be no windows in the building and only one door. The only light will be that of incandescents."

MISSOURI.

Mexico.—Holt & Son are putting up an ice house on West Liberty street, just west of the bridge, part of which will be used as a cold storage building.

NEW BRUNSWICK, CANADA.

St. John.—Dr. James Walker, of South Bay, will erect a cold storage house here. A New England firm is figuring with him for the machinery.

NEW YORK.

New York City.—The Manhattan Refrigerating Co., capital, $30,000, has been incorporated by William H. Mackay, John H. Sheridan, Frank L. Ryan, Albert S. Williams, Herman N. Hausen, Charles L. Case, of New York.

OHIO.

Massillon.—Chas. Heard is building a cold storage house in W. Tremont street.

ONTARIO, CANADA.

Toronto Junction.—McKay & McKay are erecting a large brick addition to their already spacious cold storage building on Pelham avenue. It will cost about $8,000.

PENNSYLVANIA.

Bridesburg.—Wm. Cook, engineer, Wissinoming, Philadelphia, Pa., is changing K. W. Hiller's plant from direct expansion to brine circulation. He uses one ton capacity for refrigerating, cold storage and chill rooms; his compressor is two tons capacity. Mr. Cook is adding a freezing tank also for ice of one ton capacity per twenty-four hours, in addition to the refrigeration.

Emporium.—H. J. Sassman, clerk of the county commissioners of Cameron county, writes that he contemplates going into the cold storage business.

Wilkes Barre.—M. P. Johnson has bought a Remington refrigerating machine from the Remington Machine Co. to refrigerate his bottling establishment.

SOUTH DAKOTA.

Armour.—Boysen & Thompson, of Chicago, have arranged to open a cold storage establishment in Armour, having leased rooms in the Singer block on Main street.

TEXAS.

Waco.—The Waco Ice and Refrigerating Co. have acquired additional space in order to enlarge their refrigerated storage capacity.

WISCONSIN.

Wausau.—Some gentlemen from Merrill will build a cold storage house here.

BREWERY REFRIGERATION NOTES.

——Geo. Doehm, Harrisburg, Pa., has bought a 20-ton refrigerating machine from the Pennsylvania Iron Works Co., Philadelphia.

——The Schaefer-Meyer Brewing Co., Louisville, Ky., are putting in a 75-ton refrigerating and a 30-ton ice making plant, De La Vergne machines.

——The Phœnix Brewing Co. have made a contract (second order) with the Vilter Manufacturing Co., Milwaukee, for the erection of a 100-ton refrigerating machine by the Vilter Manufacturing Co., Milwaukee.

——R. F. Erhard, brewer, Massillon, Ohio, has bought a 35-ton refrigeration machine from the Sulzer-Vogt Machine Co., Louisville; C. E. Ball, Erie, Pa., will have a 10-ton machine from the same builders in his new brewery.

——The following breweries have recently put in "Case" machines, built by the Case Refrigerating Machine Co., Buffalo, N. Y.: Mt. Pleasant Brewing Co., Mt. Pleasant, Pa., 12-ton (ice making); Chas. Ehinger, Philadelphia, 30-ton (ice making).

——The following breweries have recently bought and erected "Linde" machines built by the Fred. W. Wolf Co.: B. J. Helms, Sterling, Ill., 12-ton; Highland Brewing Co., Highland, Ill., two 25-ton; Columbia Brewing Co., Columbia, Pa., 35-ton.

——John Hohenadel, brewer, Thirty-fifth street and Queen Lane, Philadelphia, will build a cold storage building 26×56 feet, to cost $7,500. He will use a 20-ton refrigerating machine now building for him by the Vilter Manufacturing Co., Milwaukee.

——The following brewery plants have recently placed machines built by the Phœnix Machine Works, 403 Forty-seventh street, New York: A. Wintter & Co., Bridgeport, Conn., 50-ton machine; Elmira (N. Y.) Brewing Co., 25-ton machine; Chas. D. Maier Co., Mahanoy City, Pa., 35-ton machine; Mountain Spring Brewing Co., Bellows Falls, Vt., 20-ton machine.

THE short crop of ice has given a decided impetus to ice factory building, as will be seen by the record below:

ALABAMA.

Gadsden.—The old ice factory has been leased by A. C. Andrews and J. Givens, who will put it in repair and operate it through the coming season.

ARIZONA.

Clifton.—J. G. Hopkins and Henry Hill will build an ice factory.

CALIFORNIA.

Azusa.—The Azusa Ice and Cold Storage Co. has built a 3,000-ton house for storing manufactured ice, which was filled during the winter.

San Francisco.—Clot & Meese have added to their premises a 5-ton ice making plant, Linde machine, built by Fred. W. Wolf Co., Chicago.

CANADA.

New Westminster.—The Union Ice Co., of Tacoma, contemplate starting ice making and will have a cold storage plant here right away.

CENTRAL AMERICA.

San Salvador.—The Vulcan Iron Works, San Francisco, has recently shipped a 1-ton ice making plant to F. V. Nicholls, of this place, duplicating a machine now in operation.

COLORADO.

Newcastle.—Superintendent Horscheider, of the Vulcan mine, will erect an ice plant and a refrigerated packing house.

DISTRICT OF COLUMBIA.

Washington.—Nicholas Auth has purchased a 20-ton ice making machine from Westinghouse, Church, Kerr & Co. (Chicago office).

FLORIDA.

Lake City.—Messrs. Lane and Bentley, of Valdosta, Ga., contemplate building an ice factory.

Ocala.—The Ocala ice factory is preparing to enlarge its business for the summer.

GEORGIA.

Cuthbert.—I. V. Duke will erect an ice factory of ten to fifteen tons capacity.

ILLINOIS.

Aurora.—The Pure Ice and Cold Storage Co. has been organized with capital of $30,000 to build an ice factory, using a 30-ton Hercules outfit.

Champaign.—Geo. Storer, of Anderson, Ind., will erect an ice factory and cold storage warehouse. The machinery has been purchased and the plant will be in working order by the first of June.

Chicago.—Westerlin & Campbell are building a 15-ton tank for the Seipp Brewing Co., who now make ice for shipping their beer.

Chester.—The Chester Light, Water and Ice Co. have purchased of Fred W. Wolf Co., Chicago, a 10-ton ice making Linde machine.

Duquoin.—The Duquoin Iron Works has purchased a 6-ton ice making machine of Westinghouse, Church, Kerr & Co. (Chicago office), to be running May 1.

Evanston.—The Evanston Pure Ice Co., capital stock $100,000, has been incorporated by Thomas D. Perry, M. A. Cameron and George S. Baker. The company will put up about a 50-ton plant and will make ice on the plate system, using Waukesha water, which is piped from the springs to the city.

Highland.—The Highland Brewing Co., in addition to two 25-ton refrigerating machines (Linde), has bought a 10-ton Linde machine for ice making, now building by Fred W. Wolf Co., Chicago.

Peoria.—John R. Pearson, of Indianapolis, is in the city with a view to establishing an ice factory.

INDIANA.

Alexandria.—The Alexandria Artificial Ice Co. has been incorporated at Anderson, with $20,000 capital stock. The company will erect a plant in Alexandria for the manufacture of ice. L. Runyan, T. Sullivan and H. G. Boyce are the stockholders.

Bedford.—E. A. Eakin, of Jeffersonville, is talking of building a 10-ton ice factory here.

Elwood.—A company for the manufacture of artificial ice has been formed in this city with a capital stock of $50,000, headed by Philip Hamm, R. A. Anger and Daniel Benedict. The plant will be in operation by May, and will have a capacity of fifteen tons per day, and is building by the York Manufacturing Co., York, Pa. An artesian well is being sunk to obtain the water supply.

Indianapolis.—The Indianapolis Artificial Ice Co. has been organized by Peter Sindlinger, C. W. Donson, of the City Ice Co., W. H. Ballard and Willie Hollingsworth. The plant, machinery for which has been purchased, is intended for ice making purposes exclusively, and will be in operation by May 1, fifty tons capacity. The buildings will be located on West New York street, near the canal.

Indianapolis.—The Crystal Ice Co., of which F. A. Maus is president; E. Bretney, vice-president; J. C. Scharf, secretary and treasurer, and H. Arzman, superintendent, have finished their building operations. The capacity of the new plant is 100 tons daily. In addition to ice making the company will furnish cold storage.

Marion.—The Marion Ice and Cold Storage Co. has been incorporated; capital, $25,000 in $100 shares; shareholders, R. J. Spencer, C. A. Van Gorder, J. L. Barley.

Shelbyville.—The Shelbyville Ice Co. contemplate enlarging that plant from a capacity of fifteen tons to that of fifty tons daily.

Vincennes.—The John L. Ebner Ice Co. are putting in a 40-ton freezing tank, built by Westerlin & Campbell, Chicago.

KANSAS.

Coffeyville.—The machinery of the Frigid Ice Co., Joplin, Mo., is being removed to this city.

Independence.—The Independence Ice Co. has bought a 20-ton Hercules machine for ice making.

Lawrence.—A. J. Griffin and Julius Underwood have formed a partnership to build an ice factory, to be located on Pinckney street.

Winfield.—Gay & Harding have located here, where they will build a 25-ton ice making plant, work on which is progressing rapidly.

KENTUCKY.

Covington.—The Champion Ice Co. are increasing their plant to one of 100 tons daily capacity.

Louisville.—The New Albany (Ind.) Ice Co. are putting up an ice making plant here, the machinery for which has been furnished by the Sulzer-Vogt Machine Co. The plant will be running by April 15.

LOUISIANA.

Gretna.—An ice factory is in course of erection.

MARYLAND.

Baltimore.—O. Hammond, Jr., Robert C. Davidson, C. K. Mount, S. T. Clark, Howard Hammond, Henry A. Parr and several others have incorporated the Arctic Skating Co. with a capital stock of $200,000. It is the company's intention to build a rink for skating on artificial ice during the summer season. The Messrs. Hammond mentioned are probably the best parties to address.

Baltimore.—The Maryland Ice Co. are making additions to their ice making plant, the Hercules Ice Machine Co., Aurora, Ill., having the work in charge.

Elkton.—John E. McGaw, of Washington, D. C., is interested in an ice factory project to be located here.

Hagerstown.—The Bester Ice Co. has awarded the contract to build a 20-ton ice plant here to the Hercules Ice Machine Co., of Aurora, Ill., to be running by June 1.

Westminster.—The directors of the Ice and Cold Storage Co. have closed a contract for an ice machine, on the plate system, with the Remington Machine Co., of Wilmington, Del.

MISSOURI.

Charleston.—The Sulzer-Vogt Machine Co. are building a 10-ton ice machine for McElroy & Hequembourg, of this city, to be in operation by April 15.

Sedalia.—The Sedalia Ice Manufacturing Co. is preparing to increase the capacity of its plant. Among the improvements may be mentioned an additional battery of steam boilers, a plant for gradirworks for cooling condensing water and additions to the piping and fitting of its storage rooms. This will require an expenditure of $15,000. The company proposes to develop its cold storage facilities and expects to pack poultry and game of every sort, as well as eggs.

MISSISSIPPI.

Meridian.—The Meridian Ice Co. will sink an artesian well, to cost $5,000.

McComb City.—The ice factory lately noted will be built by the McComb Ice Factory and Bottling Works, Frank Kaye, manager. Bottling plant will also be put in.

Tupelo.—Sam'l Kaye, of Columbus, will erect a branch factory here, by removing to this place some of the machinery of the Columbus plant.

NEW JERSEY.

Bridgeton.—Local capitalists have subscribed $40,000 for the erection of an artificial ice plant.

Camden.—The New Jersey Ice Co. is having a building erected at Second and Erie streets, in which to manufacture ice

on a large scale. The company has a capital of $300,000 and will spend $127,000 on the plant, the capacity of which will be 100 tons a day.

Camden.—The Camden Ice Mfg. Co. is a new company, with Geo. Pfeifer as president; capital, $65,000. They will build a 40-ton plant, can system, using a Frick machine. The plant will include also an electric light outfit.

Monroeville.—Randolph & McFarland have bought a Remington ice machine, can system, built by Remington Machine Co., Wilmington, Del.

NORTH CAROLINA.

Rocky Mount.—W. E. Worth, of Wilmington, N. C., it is reported here, will erect an ice plant.

OHIO.

Cleveland.—The Sheriff Street Market and Cold Storage Co. will put in at once for ice making a 30-ton Linde machine built by the Fred W. Wolf Co.

Cincinnati.—The newly organized Consumers' Ice Co. has made a contract with W. P. Callahan & Co., Dayton, Ohio, for their machinery—a 45-ton ice making plant, consisting of one 30-ton and one 15-ton machine. The buildings will be erected on Spring Grove avenue. The main building will be of stone and brick, two and three stories high, covering a plat of ground 106 by 134 feet in size. Here will be located the offices, the rooms for storing ice, and ice tank. In the rear of the main structure and separated from it by a narrow alley the boiler and engine rooms will be located in a building 40×65 feet. The slaughter house will be 30×50 feet, and attached to it will be the cattle pens, etc. The work of construction has begun and will be pushed rapidly.

East Liverpool.—G. W. Meredith, Ph. Morley, Jos. Turnbull and T. A. Corcoran contemplate building an ice factory here.

Sandusky.—The Kuebeler Brewing and Malting Co. are going to make ice, having placed a contract with Westerlin & Campbell, Chicago, for a 20-ton freezing tank.

OKLAHOMA.

Guthrie.—The Pabst Brewing Co., March 6, broke ground for a $100,000 ice making plant.

PENNSYLVANIA.

Chambersburg.—A company has been formed here to manufacture ice. Geo. D. McIlvaine, son of Cashier Jno. L. McIlvaine, of the National bank of Chambersburg, will be the manager. The apparatus will be built by Frick Co., Waynesboro. The company expects to furnish ice to Chambersburg patrons and to other parties who may desire to purchase it.

Beaver Falls.—Leonard Strub has bought machinery for his new ice factory from the Pennsylvania Iron Works Co., Philadelphia, to-wit: one machine of fifteen tons ice making and five tons refrigerating capacity. Work has begun on the building, which will be 125×36 feet, two stories high.

Philadelphia.—The Consumers' Ice Manufacturing Co. has purchased property at the southeast corner of Seventeenth street and Washington avenue, and will begin at once the erection of a new ice plant upon this site, which will double the daily output of their present plant at Thirty-first and Walnut streets, and increase the company's ice making capacity to over 100 tons per day. The company will equip the new plant with new machinery like their present plant of the Consolidated pattern, single acting, with horizontal engines. The company has elected Henry Mosebach, president; William F. Herbert, vice-president; William McKnight, secretary and treasurer; and Louis A. Haustetter, superintendent.

Philadelphia.—H. F. Mellick is president of the newly organized Jefferson Ice Manufacturing Co., with capital paid in of $150,000, who are now erecting works at the corner of American and Cumberland streets. The other officers are: J. E. Bircher, vice-president; G. P. Kinzle, secretary, both of whom were lately with the Consolidated Ice Manufacturing Co. The company will erect two 40-ton Kilbourn machines, to be running by June 1. The Lea Pusey plate system will be used. The Jefferson Ice Co., to which the new company succeeds, has on its books some 2,500 customers using from eight to fifty tons daily, who are expected to take the full production of the new factory.

Reading.—The Reading Ice Co. have ordered a 50-ton ice making machine from the C. G. Mayer Ice Machine Co.

TENNESSEE.

Memphis.—The Consumers' Ice Co. has applied for a charter to build an ice factory; incorporators, B. C. Bruce, W. H. Daragh and others. They will use a Hercules machine now being erected.

Nashville.—The Hercules Ice Machine Co. is building a duplex condenser for the 30-ton Boyle machine operated by the Nashville Ice Co.

Pulaski.—The Pulaski Ice Co.'s plant has been thoroughly overhauled—reconstructed. Preparations are making for building an addition for cold storage.

TEXAS.

Atlanta.—Campbell & Howe are in the market for machinery.

Cuthbert.—A contract was executed March 10 for the erection of an ice factory here.

Dallas.—It is announced by Chas. Meisterhaus, agent of the Lemp Brewing Co., of St. Louis, that his principal will erect here an ice factory and beer depot to cost $100,000. The new plant will be located in East Dallas near the company's present depot, and will have a capacity of 150 tons of ice daily. It will be in operation in June.

VIRGINIA.

Alexandria.—The work of enlarging the plant of the Alexandria Ice Co., foot of Cameron street, is completed. The changes just made will make the capacity twenty-five tons of ice per day. The plant makes ice by the plate system, in cakes twenty feet long, five wide and six deep.

Bedford City.—The erection of an ice plant is rumored.

Harrisonburg.—H. C. Pankey will erect an ice plant of about seven tons capacity, with cold storage rooms attached, and will put in a dynamo for lighting purposes. Work on buildings will commence at once.

Norfolk.—The Hygeia Ice Co. has commenced the enlargement of its plant.

Radford.—C. K. Mount can give information of an ice factory to be built here.

Winchester.—R. A. Beverly is interested in an ice factory project here.

UTAH.

Salt Lake City.—The Salt Lake Ice Co. has recently overhauled its ice factory, which is now in operation after a stoppage of several months.

WEST VIRGINIA.

Harper's Ferry.—James McGraw has bought a Remington ice machine, built by Remington Machine Co., Wilmington, Del., and will erect an ice factory with cold storage addition.

NEW BOOKS.

WHAT AN ENGINEER SHOULD KNOW ABOUT ELECTRICITY. By Albert L. Clow, E. E. The Mason Regulator Co. Boston. 16mo, pp. 118; price, 50c.

This is a valuable addition to the Mason Regulator Co.'s series of guides and pocket books for engineers. After giving a short but comprehensive explanation of fundamental principles and terms, the apparatus and machinery used in the generation and application of electricity for lighting, transmission of power, their installation, regulation and rectification, are thoroughly discussed in language which appeals to the understanding of the practical engineer.

The Mason Regulator Co. has also published a "Chief Engineer's Log Book" which contains 200 sheets small folio size, each sheet being ruled to receive entries regarding the different temperatures, pressures, etc., obtaining in the operation of steam engines and boilers. The price of this work is seventy-five cents. A similar book of forms called the "Engineer's Log Book" is also published by this company, and the price of it is fifty cents; 200 pages ruled and headed blanks. Doubtless the publications of this firm are a great assistance to the thinking engineer who desires to operate his plant rationally, economically and with the least amount of irregularity and disturbance.

REPORT OF THE SECRETARY OF AGRICULTURE FOR 1892. Washington: Government Printing Office, 1893. 8vo, cloth; pp. 656.

As appears from this volume there are some twenty departments under the secretary of agriculture, among them those of animal industry, chemistry, pomology, microscopy, forestry, statistics and many others. The annual reports of the chiefs of these departments to the secretary are embodied in this volume; and these reports give either full descriptions of the work done or a comprehensive synopsis of the same. The volume is illustrated by a number of finely executed colored plates, showing mushrooms, fruits and other subjects.

HANDBOOK OF EXPERIMENT STATION WORK. Published by authority of the Secretary of Agriculture. Washington: Government Printing Office, 1893. 8vo, paper; pp. 408.

As is doubtless known to most of our readers, not only the United States as a whole, but also most if not all individual states, maintain agricultural experiment stations of their own for the chemical examination of agricultural products, manures, soils, etc., for the execution of feeding experiments and a number of other purposes. The results of such investigations are published from time to time, and generally in irregular issues. The present volume contains a short but comprehensive and popular digest of all these labors, and will be found an excellent guide by all those interested in them.

——Alfred White, brewer, Ottawa, Ill., has made a contract with the Hercules Ice Machine Co., Aurora, for the erection of a 10-ton refrigerating machine in his brewery.

TRADE CORRESPONDENCE.

AN EXPLANATION—STOPPING A LEAK IN A BRINE TANK—HOW THE TRADE IS DEMORALIZED—VARIOUS LETTERS.

[The publishers of ICE AND REFRIGERATION do not hold themselves responsible for the opinions expressed by correspondents on any topic; but these columns are at all times open for the discussion of subjects of interest to the trade, and such correspondence is at all times welcomed. Our readers are cordially invited to contribute to this department by giving their views on questions propounded, or by suggesting original topics for trade discussion, or notes on the condition of trade in their section of the country. Anonymous letters will receive no attention whatever.—ED.]

AN EXPLANATION.

To the Editor: We noticed in a trade paper the following item: "A motion for the appointment of a receiver for the Bird Paper Manufacturing Co., of Hoboken, N. J., has been made. The liabilities of the firm are said to be $18,000 and the assets $8,000." The truth of the matter is this; the motion for the appointment of a receiver was the outcome of ill-feeling among some of the stockholders, and there is no ground for appointing a receiver, for the reason that the company has assets of $46,019.59 and liabilities $17,358.32. About 90 per cent of the liabilities do not become due until the fall. Our business continues as usual, as the court has dissolved all restraint which the motion for the appointment of a receiver carries with it. The board of directors desire to uphold the credit of this company, and it is with this end in view that we address this communication to you.

THE BIRD PAPER MANUFACTURING CO.

NEW YORK, March 6, 1894.

STOPPING LEAK IN BRINE TANK.

To the Editor: In your issue of October, 1893, in the "Answers to Correspondents" department, it is asked how to stop a leak in the bottom of the brine tank; and the information given does not include the more common methods. I would suggest that the leak can be stopped by putting a small amount of corn meal or bran into the solution near the point where the leak occurs. If the exact location of the leak can be determined, the substance can be placed very nearly where required and without mixing with the balance of the solution sufficient to get enough into the pipes to interfere with the pump in any way, by placing an open pipe in position so that the bottom comes near the leak. Then by applying the corn meal a little at a time, enough of it will find its way into the leak, being drawn there by the current, to effectually stop it. This is a method that has often been successfully used in a leaky boiler.

As a suggestion to A. T. F., in the same issue, where he asks for a method of reducing the smoke and consequent waste of fuel, I would suggest as a practical method that he increase the draft, by artificial means if necessary, and at the same time reduce the area of grate surface to the lowest practical limit. The latter he can do by allowing an accumulation of ashes on the grates near the bridge wall, leaving them undisturbed until he finds how much of the grate surface he can dispense with. There are many ways by which the draft can be increased without adding to the height of the chimney, which in reality never pays for the expense incurred. A circle of steam jets placed inside the chimney will more than pay for all the steam thus consumed, if the jets are properly arranged and not too large. Jets less than one-eighth of an inch in diameter will be large enough, and four to twelve or more may be employed. By reducing the grate surface more efficient combustion will be obtained, for the hot surface thus presented will aid in securing complete combustion. Air admitted in proper quantities, in front of the bridge wall, will reduce the amount of smoke produced and greatly aid combustion. If A. T. F. has not secured satisfactory results by this time, I will be pleased to give a further description which I think will suit his plant, if he will more fully describe the kind of furnace, bridge wall, area of grates, amount of coal burned, strength of draft, etc. JNO. EARLY.

CHICAGO, ILL., March 23, 1894.

HOW IT APPEARS.

To the Editor: The ice business is inclined to be overdone, and it requires conservative management now to get a profit. We ourselves have just put in a 75-ton machine, making our capacity nearly four times the consumption of our town in hottest weather. This to head off greenhorn "capitalists" and investors, who go off in some quiet place and figure without any practical knowledge, and invest foolishly and act foolishly, and spoil the ice business for themselves and others already occupying the field; and it almost always turns out that the promoter is some broker or other penniless sharper who is only working for the commission on the sale of the machinery. L. W. C.

LITTLE ROCK, Ark., March 20.

FROM CALIFORNIA.

To the Editor: Distilled water ice is gradually growing in favor with our people, and as we can furnish it at a lower rate than natural ice can be furnished, we will have our advantage.

The Union and National Ice Cos. have called in many of their retainers, and are now harmonious after a two years' war They desire us to come into the fold, and thus elevate the rate for ice, but so far the inducements have not been commensurate with our capital and position, and do not offer us anything better than we have had in our independent course.

I cannot speak too highly of your paper. It has been the principal source of information I have had on the ice subject, and is of very great advantage to me. R. G. SNEATH.

SAN FRANCISCO, March 20.

TOO MANY MACHINES.

To the Editor: Our largest consumers are fishermen, who take about one-half of our output, which is only six tons per day, our plant being a small one. There is no natural ice coming near this section, so we cannot give you any information on that point. Our fishermen, who have used in their time both natural and our manufactured ice, claim that our ice will beat the natural product fully 20 per cent. Our worst trouble here is that there are getting to be too many machines, so there is not demand for all that can be manufactured, and a portion of the time the machines have to lie idle. It is a hard country to store ice in, as it seems almost impossible to keep it any length of time on account of shrinkage. WETMORE & GLADWIN.

TITUSVILLE, FLA., March 19.

CHANGED HIS MIND.

To the Editor: If not out of place here, I would say that there is an opening for a small machine in the best little city in the South, viz., at Eustis, Fla. It is a fine place for residence; a former machine having done well, but was moved to Leesburg.

The only comment of the season to be made as to the popularity of manufactured as compared with natural ice is the fact that the oldest dealer in lake ice in this city, who has denounced machine ice for containing chemicals, etc., for the last four years, was the first one to secure the entire output of the new machine long before it was completed, and now recommends it highly. So the march goes on.

SPRINGFIELD, ILL., March 17. W. B. B.

HOW THE TRADE IS DEMORALIZED.

To the Editor: The manufacture of ice is greatly overdone here by all the breweries going into it, and it results disastrously to the legitimate trade, and the result is at the end of the season there is a great deal of growling and grumbling. There are today some twenty-five or thirty men who have horses and wagons who go to the breweries and get a few cans of ice, and out they go to sell the same, and about noon they sell for whatever price they can get.

The regular dealers tried very hard to regulate a living price by meeting and having these parties to come in and have a say in the matter, with the result mentioned as to prices, but there is no way to hold them strictly to them. We tried, and so did the experienced dealers, to have the brewers cut off their supply, if it was proved they were selling under the list, but I have grave doubts as to whether they will do so or not, as one of the largest manufacturers said in open meeting that he made his ice to sell, and sell he would.

Having had fourteen years' experience in this business, it seems to me to get worse and worse year by year, and I can see only bankruptcy staring the ice trade in the face, if we cannot make some regulations governing the same.

LOUISVILLE, KY., March 19. HAMILTON GRISWOLD.

HOW HE HANDLES HIS ICE.

To the Editor: I use the York machine, and make ice from water which the chemist's report shows contains forty grains solid matter the gallon; and 75 per cent of the ice users prefer my ice to the Maine ice. I draw ice from the freezing tank and put it direct into the wagon, and my customers get it within one hour from the time it comes from tank. My cakes weigh 220 pounds, and it delivers in small lots an average of 200 pounds, and in lots of one ton or more. We do not weigh it to the customers, but give them a cake for 200 pounds. Ice sold in this town before I put in machine for $1.25 per 100 pounds; I put in the machine in 1892, and put ice to the present price and kept it there. F. E. SMITH.

HOLLY BEACH, N. J., March 19.

AGAINST STORING ICE.

To the Editor: We do not advocate storing ice manufactured for the trade during summer, but prefer instead to have large freezing tank capacity. In this way we save a great deal of unnecessary meltage. We deliver ice to our city trade twice a day, morning and evening, and find this gives the best satisfaction.

Allow us to say in connection, we enjoy ICE AND REFRIGERATION very much, and find in it many valuable and practical suggestions. "Long may it wave." C. I. & C. Co.

CLARKSVILLE, TENN., March 17.

STORING ICE LAST OCTOBER.

To the Editor: We stored last October 300 tons of machine ice, and have some of it on hand yet. It kept fine. We are taking out blocks that weighed 200 lbs. when stored, that now weigh 190 to 195 lbs. We find it pays to store enough ice in October to supply our local trade during winter, and shut down machine. Will start up April 1 for season's run.

PARIS, TEX., March 20. THE PARIS ICE CO.

ICY ITEMS.

——O. W. Hoskins will handle ice this season at Fairfield, Iowa.

——J. W. Westwick has entered the retail ice trade at Galena, Ill.

——M. Cavanaugh has sold his ice business at Utica, Ill., to Geo. Burgess.

——John & George Dipple are going into the ice business at Hazleton, Pa.

——J. B. McNabb is building a 700-ton ice house at his factory at Salem, Ohio.

——Babson & Co. have purchased the ice house of Elijah Norton at Dover, Me.

——The Mobile & Ohio Railroad Co. recently placed an order for 100 refrigerator cars.

——H. H. Bean has purchased the ice business of E. P. True at Amesbury, Mass.

——Crystal Ice Co., Youngstown, Ohio, has been reorganized with a capital stock of $50,000.

——A. Y. Reed has bought Peter Fay's interest in the ice business of Fay & McBride, at Elgin, Ill.

——F. R. Shepard & Son, Fond du Lac, Wis., have purchased the ice business of L. T. Treleven.

——The Manchester (Va.) Transparent Ice Co.'s plant will be operated this season by Geo. Paul & Bro.

——A new ice company has been organized at Farmersville, Ohio, who cut ice on the water works reservoir.

——Fogarty & Webb, ice dealers, Lansingburgh, N. Y., have dissolved partnership. Both will hereafter go it alone.

——F. Saunders & Co. have purchased the cold storage and commission business of Flumerfelt & Leech at Port Huron, Mich.

——The Cook & Genung Co.. Newark, N. J., has been organized to handle ice, etc., by Horan P. Cook and others; capital, $50,000.

——Thos. McBride has sold his ice business at Elgin, Ill., to C. R. Greenlee and Chas. Graydon, of Elgin, and Henry McBride, of Chicago.

——The Twin Lakes Ice Co., with capital of $30,000, has been incorporated at Chicago, by C. J. Schmidt, Henry Busch and Fred. W. Huttenlocher.

——Westinghouse, Church, Kerr & Co. have removed their New York offices from 17 Cortlandt street, where they have been for ten years, to 26 Cortlandt street.

——The Danbury (Conn.) Ice Co. recently elected the following officers: Robert Sayer, president; George Beers, secretary and treasurer; Smith Beers, general manager.

——W. H. Smith, Norwalk, Cal., has bought a small refrigerating machine (Westinghouse, Church, Kerr & Co., Chicago office), for cooling creamery buildings and storage.

——Ira C. Ward has leased the ice houses of Henry W. Tillson at Plymouth, Mass. Mr. Tillson thus retires from the business, with which he had been connected since 1867.

——The Cook County Hospital authorities, Chicago, have purchased a 10-ton refrigerating machine (Westinghouse, Church, Kerr & Co., Chicago office), for cooling storage rooms, etc.

——The Polar Construction Co., 45 Broadway, New York, have taken a contract for a 6-ton ice and refrigerating plant for the new Bloomingdale insane asylum at White Plains, N. Y.

——The C. F. Peterson Coal Co., Grand Rapids, Mich., has decided to go into the ice trade as the C. F. Peterson Coal and Ice Co. The company has filled houses holding 4,000 tons of ice.

——The Connersville ice factory, operated by Evans Bros., has been sold to Hon. J. N. Huston and others, who have incorporated the Connersville Hygeia Ice Co., with capital of $20,000.

——The Lehigh Valley Cold Storage Co., South Bethlehem, Pa., have elected the following officers for 1894: President, Adam Brinker; vice-president, David Thomas; secretary, J. B. Meixell.

——The Arthur Jordan Co., Indianapolis, was incorporated February 26, by Arthur Jordan, Milton A. Woolen and Chas. W. Sutton; capital, $100,000; the company will handle ice, produce, etc.

——The La Belle Ice Co., Oconomowoc, Wis, received its charter March 9, when their ice house was about completed. It is the largest in the city, excepting that of the Knickerbocker Ice Co., Chicago.

——Dr. Fahrney & Sons' Co., 112 South Hoyne avenue, Chicago, manufacturers of medicines, have purchased a "Linde" machine from the Fred. W. Wolf Co., to cool medicines and a storage house.

——The ice factory company at Ogden, which recently went into the hands of a receiver for the purpose of settling up the affairs between stockholders, will be reorganized and the works again put in operation.

——The Afro-American Ice, Coal and Fuel Co. and fifty owners of teams, at St. Louis, will endeavor to organize as an incorporated body. W. H. Huston has been elected chairman, and W. T. Thornton secretary.

——At the annual meeting of the Reading (Pa.) Cold Storage Co., held March 8, the following officers were elected: President, C. Q. Guldin, of Pottstown; secretary, J. F. Christman: treasurer, George O. Runyeon.

——The Polar Construction Co., New York, has erected a 12-ton refrigerating plant for the College of Physicians and Surgeons, of New York city, to be used for manufacturing ice and for cooling the dissecting and other large rooms.

——At the late annual meeting of the Middletown (N. Y.) Ice Co. for the election of directors, etc., the following were chosen directors: Messrs. W. F. O'Neill, J. H. Drake, W. D. Stratton, C. Macardell, T. A. Weller, W. D. Brown, L. G. Wilson, J. D. Wood, E. A. Brown.

——The Munice (Ind.) Artificial Ice Co. has elected the following officers for 1894: Henry Klein, president; W. L. Little, secretary; George W. Spilker, treasurer; Carl Sample, superintendent; J. A. Heinsohn, W. L. Little, Carl Sample, Henry Klein and George W. Spilker, directors.

——The Salem Spring Ice Co. has been organized at Naugatuck, Conn., with a capital of $5,000, in 200 shares of $25 each, 20 per cent paid in. The subscribers are: J. L. Murphy, Patrick Brennan, M. F. Coen and Kate Coen, each forty shares, and J. A. Maher and J. H. Dunn, each twenty shares.

——The Quaker City Cold Storage Co., Philadelphia, has elected the following officers for 1894: John J. MacDonald, president; Joseph J. Martin, vice-president; J. J. Habecker, secretary; L. H. Stephens, Jr., treasurer and manager; directors, John J. MacDonald, Joseph J. Martin, Wm. J. Latta, Thomas B. Shriver, Jacob J. Hitschler, Jacob F. Miller and E. G. Dixon.

——The Consumers' Ice Co., Lexington, Ky., has elected the following officers and directors for the ensuing year: T. A. Tierney, president; E. B. Ellis, secretary; W. V. Lindsay, treasurer; J. E. Fitzgerald, manager; board of directors, Wm. Sleath, Joseph Lanckhart, E. T. Graves, J. E. Hanna. The company has arranged to secure all the ice they may need from the Wagner Lake Ice Co., of Sandusky, Ohio.

——The Chattanooga *Times*, on the authority of Mr. C. W. Biese, says: "More ice is sold in Chattanooga in winter than in summer," and explanation of the phenomenon is the following: "In summer ice sold is principally used for consumption by families, hotels, restaurants and saloons. Chattanooga is a great shipping point, and in the winter ice is packed to preserve vegetables and fruits. A great amount is used in replenishing refrigerator cars that make connection in this city. In winter the sale of fresh meats is larger, and when shipped is packed with ice."

MINOR LEGAL NOTES.

——B. C. Addition has been appointed assignee of the American Ice Co., at Bayard, Me.

——At St. Louis the American Ice Machine Co. recovered judgment of $388.15 against the C. B. Woodward Printing and Book Manufacturing Co., who had purchased a 1-ton machine for $926, and was delinquent for $362 of the payment on claim that the machine did not fulfill contract stipulations.

——The foreclosure recently of the mortgage on the plant of the Crowell & Class Cold Storage Co. (which long since passed out of the hands of both Messrs. H. P. Crowell and Chas. Class, the original owners of the business) has disclosed a financial situation which threatens to involve a good deal of future litigation. It is indeed charged that the manner of floating securities has not been entirely without gross carelessness, and that many holders of mortgage bonds will lose heavily.

——On March 12 the City Ice Co., at Indianapolis, Ind., began an action for $10,000 damages against Chas. Donson and Willis Hollingsworth. It was alleged, in substance, that the defendants had conspired together to injure the plaintiff's business for the season of 1894-95 in that Messrs. Donson and Hollingsworth, while in the employ of the plaintiff as city solicitors, went to the proprietors of various hotels and restaurants, ice cream manufacturers and the creameries and represented that the plaintiff intended to raise the price of ice for the approaching season, and had thus greatly injured the plaintiff's business by making it a difficult matter for the plaintiff to perfect contracts with its old customers. The defendants to the suit are members of the newly incorporated Indianapolis Artificial Ice and Cold Storage Co.

——On March 10 the J. R. Morin Co., produce dealers, with headquarters at Cedar Rapids, Iowa, and branch houses at various points in Iowa and Nebraska, failed. This failure precipitated also that of J. R. Morin & Co., Hastings, Neb., Morse & Smith, of Boston, and their branches at Ogdensburgh and Winthrop, N. Y. The company's capital was $90,000, and liabilities were estimated on day of failure at $210,000 as a total for the various houses. The collapse of the egg market, causing a loss of $80,000, is said to have caused the failure; as well as this other claim reported by the news correspondent at Cedar Rapids: "A couple of years ago the company branched out into the wholesale fruit trade, which, it is understood, has not been profitable, or indirectly has caused a heavy loss. The fruit and eggs were stored in adjoining rooms with double iron partitions, yet the flavor of lemons was carried through and contaminated about fifty car loads of eggs, 600,000 dozen. The eggs were sold at a discount of three to four cents per dozen, entailing a loss of over $20,000."

THE committee of the French Chamber of Deputies has decided to consider and to submit to the army commission a proposal introduced by several deputies to the effect that the government may establish under state control tinned meat factories, so that the army may be served with a better quality of tinned meat in times of peace and war, without having recourse to foreign countries. It is said the motion is certain to be rejected, as previous similar proposals have been.

THE Schwarzschild & Sulzberger Packing Co., of Kansas City, Kan., has begun the experiment of shipping dressed mutton to England. The company January 12 made the first shipment of a few carcasses, but since that time several shipments have been made, growing larger each time. This company is the first to export dressed mutton to England from Kansas City, and their agents in England have written hopeful reports of the experiment. This experiment of American mutton competing with that from New Zealand and the Australias will be watched with more than usual interest; for of late years the export of mutton to England from America had practically ceased.

CONSUL-GENERAL Judd reports to the state department at Washington, from Vienna, that 11,000 pounds of frozen Australian beef reached that city after being repacked in London, and that it readily sold for ten cents a pound. He points out that this consignment was over a month in transit, and that United States shippers would have many advantages over those of Australia in point of time and freight charges.

PACKING HOUSE NOTES.

——G. W. Force has discontinued his pork packing plant at Vancouver.

——The Ryan Packing Co., Dubuque, Iowa, have put up 10,000 tons of ice.

——A stock company is being formed to start a pork packing house in Hazelton, Pa.

——D. M. Drumheller, of Spokane, Wash., is at the head of a project to put up a packing house at Spokane.

——The A. Sanders Packing Co., Cincinnati, will erect a new storage house, to be four stories high. It will cost $6,000.

——It is announced that the pork packing establishment of the late James M. Ryan, at Galena, Ill., will be running in full blast next winter.

——J. & F. Schroth Packing Co. has purchased a 50-ton refrigerating Linde machine, built by the Fred W. Wolf Co., for cooling their packing house.

——Hammond, Standish & Co., packers, Detroit, Mich., have purchased a 75-ton Linde refrigerating machine, built by Fred W. Wolf Co., Chicago.

——The Kenwood Packing Co. has been incorporated at Chicago; capital, $100,000; incorporators, Albert H. Veeder, H. C. Gardner and Henry Veeder.

——Armour & Co., Chicago, put up about 12,000 tons of ice at Cedar Lake, Indiana, near Crown Point. The capacity of their houses at the lake is about 60,000 tons.

——George Pfonstiel will build a large addition to his packing house in Kansas City. The new building will be 50×100 feet in dimensions and three stories high. It will be used for the manufacture of ice.

——The Pennsylvania Iron Works Co. recently contracted with the packing house of Jacob T. Alburger & Co., of Philadelphia, to remove old refrigerating machinery and replace it with one of their own machines of 35 tons capacity.

——The Vilter Manufacturing Co., Milwaukee, is overhauling the packing house of William Plankinton at Milwaukee, putting in new condensers and coil work, so that the packing house can shortly be started up again. This plant is refrigerated by a 100-ton Vilter machine.

——The Swift Packing Co., South Omaha, Neb., recently made the largest shipment of dressed hams that has ever left that packing point. It consisted of thirty car loads and brought the sum of $70,000. The consignment was made to Whitney & Co., of San Francisco, Cal. The total weight was 750,000 pounds.

——The Western Packers' and Canners' Association, at the annual meeting at Chicago, February 15, elected officers as follows: President, R. P. Scott, Baltimore; vice-president, R. O. Conan, Portland, Me.; secretary and treasurer, John T. Staff, Cayuga, Ind. The next annual convention will be held in Chicago,

——The Plankinton packing house, at Milwaukee, which has been idle since it was vacated by the Cudahys in October last, will be reopened April 1 by a company made up of William Plankinton, George B. Vannorman and two Cincinnati packers. William Plankinton will be president, and Mr. Vannorman general manager.

——The Fowler Packing Co., Kansas City, has prepared plans for remodeling the beef killing department at its establishment at Kaw point. The beef house was built in 1880 and its capacity is insufficient for present needs. The plans provide for such extensive improvements and enlargements that the capacity will be increased to 500 beeves daily.

——On March 5 the cold storage building of Cudahy Packing Co., Sioux City, Iowa, collapsed and was a total wreck. The building was put up in January, was of brick, two stories and a basement, and there were about ninety tons of ice and twenty tons of meat in the building at the time; loss, $45,000 on building, and $20,000 on contents. The building will be rebuilt at once.

——The Indianapolis (Ind.) Abattoir Co. is to expend $50,000 in enlarging its plant, and expects to largely increase its business. The company is now killing 1,500 head of cattle a month and several thousand hogs and sheep. Additional buildings are to be put up, besides an artificial ice manufacturing plant, which it is estimated will cost $20,000. The engine and boilers, tanks, etc., have already been contracted for, as it is expected to have the plant in operation in the early spring.

——Negotiations are now pending which will probably result in the resumption of work at the Allcutt packing house in Armourdale, Kan. A new company, capitalized at $200,000, has been formed and much of the stock has been taken by eastern and local capitalists. For five years preceding 1891 the Allcutt company did a successful business and furnished employment to about 200 men. In the last mentioned year a series of misfortunes rendered an assignment necessary, and since then the valuable plant has lain idle. It originally cost $175,000.

——J. E. Landrum has filed suit for $10,000 against the Reid Bros.' Packing Co., of Kansas City, Kan. Landrum was foreman of the lard department of the house, and in that capacity claims he had knowledge of some secret process in rectifying the product. The company, he claims, induced him to give information of the process to an assistant, and then as soon as the assistant was able to care for the business the plaintiff was discharged from the employ of the company. He says that in consideration of his instructing the assistant he was promised permanent employment with the company. He thinks by his discharge he was damaged in the sum of $10,000.

——The Ottawa, Ont., *Free Press*, February 16, says: "Mr. Bender, of Three Rivers, the promoter of the celebrated dead meat scheme, by which, under a cold storage system, it is proposed to carry the carcasses of beef and mutton from Canada to the European market in refrigerator vessels, has been here for some days to talk over the scheme with the government, and to secure aid out of the Dominion treasury. Mr. Bender is said to have associated with him Mr. Charlebois, who built the Langevin block. The basis of operations is to be changed from Three Rivers to Levis. They are asking the government to guarantee 4 per cent interest for ten years on their bonds to the extent of $500,000. They will also ask that for five years they shall receive out of the Dominion treasury an annual subsidy of $125,000 to pay the expenses, as they state, of running the refrigerator vessels.

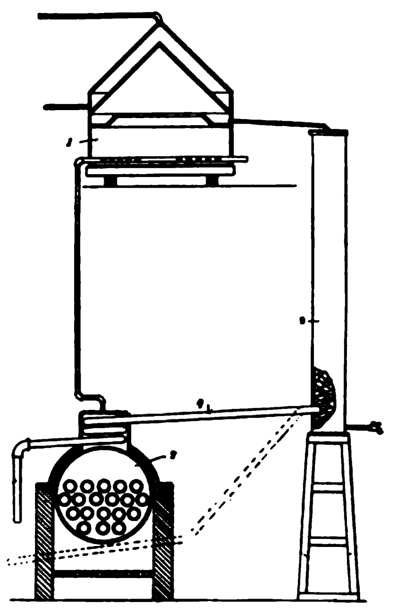
——The packing and provision plant at Rodeo, Cal., will, according to a San Francisco paper, soon be sold to a new corporation with large capital. The transfer will be made prior to May 1 next. The incorporators of the succeeding company will be: L. Bleichroeder & Co., bankers, Berlin; R. H. Scott Ritchie, banker, London; S. Alfred W. Bevan, banker, London; O. B. Schleisinger & Co., bankers, London and Berlin; H. P. Plankington, Milwaukee; H. S. Perkins, Erie, Pa.; O. T. Smith & Co., Denver; two wholesale butcher firms in San Francisco and one butcher firm in Butte, Mont. The new company will not confine its business to the Pacific coast or the United States, but will seek a trade in South America, Mexico and other foreign ports. More remarkable than all else, however, is the statement that, "It is their intention to handle all their meats in the natural way. There will be no refrigerator meat used except the cured meats which will be operated under the refrigerator process." What a "beautiful time" Mr. P. N. Schlesinger, of Oakland, who will be chosen general manager of the new company, will have, surely!

We append below the most important new patents relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for ICE AND REFRIGERATION.

AERATING DISTILLED WATER.

No. 502,409. James E. Thomas and Elisha P. Grow, Bay City, Mich. Filed January 31, 1893. Serial No. 460,307. Patented August 1, 1893. (No specimens.)

Claim.—The process herein described for producing distilled and aerated water, which consists in distilling and condensing water, directly confining and subjecting atmospheric air for a prolonged period to an independent source of heat of the desired temperature, and combining the said heated air and distilled water in an aerator, substantially as set forth.

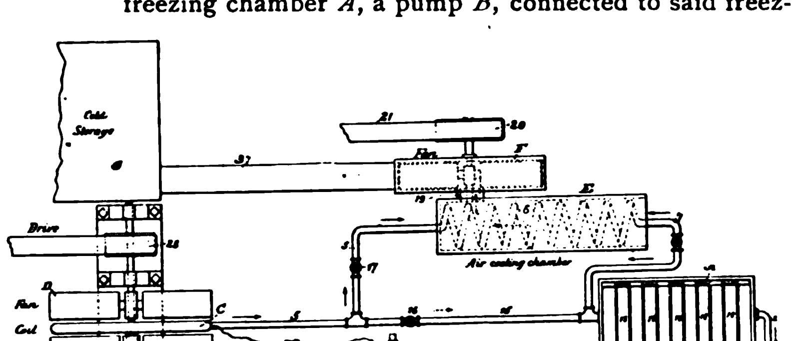


REFRIGERATING APPARATUS.

No. 512,175. James J. Faulkner, Memphis, Tenn., assignor of one-half to George W. Washburn, same place. Filed December 26, 1890. Serial No. 375,796. Patented January 2, 1894. (No model.)

Claim.—1. The combination with the chamber *A*, pipe connection leading therefrom, the coil *C* consisting of a porous covering and contained pipe and with which said pipe connection communicates, having intermediately of its covering and contained pipe a spiral wire forming a water space, fans *D D* for cooling said coil and the reburn pipe 5 leading from the coil to the freezing chamber, as and for the purposes explained.

3. The combination in a refrigerating system, of a freezing chamber *A*, a pump *B*, connected to said freez-



ing chamber by a pipe 1, a cooling coil *C*, a pipe 3, connecting said cooling coil to said pump, air-cooling chamber *E*, a pipe 5 connecting said cooling coil and air-cooling chamber, a pipe 7 connecting said freezing chamber and air-cooling chamber, and a cold storage chamber *G*, having a passage 37 communicating with the air-cooling chamber, as explained, substantially as set forth.

PATENTS EXPIRED JANUARY 16, 1894.

Re-issue No. 7,467. Refrigerator cars, by J. M. Ayer, Chicago. No. 181,391, August 22, 1876. Filed October 16, 1876.

No. 186,200. Refrigerators, G. H. Crisfield, Yonkers, N. Y. Filed March 25, 1875.

CONSOLIDATIONS.

——The consolidation of the ice companies at Grand Rapids, Mich., was effected on March 15, the new company to be known as the Consumers' Ice Co., with authorized capital of $100,000, of which $58,200 is now paid in. The stockholders are Cornelius C. Clark, 620 shares; N. Fred Avery, 500; James E. Furman, 500; Frank Bonnell, 702; H. R. Dickinson, 702; A. S. Ainsworth, 696; C. C. Follmer, 500; James Grant, 472; A. B. Knowlson, 1,100, and Joseph Horner twenty-eight shares, who are the chief stockholders and managers of the Grand Rapids Ice and Coal Co., Valley City Ice and Coal Co., South Grand Rapids Ice and Coal Co., S. P. Bennett Fuel and Ice Co., Grant Fuel and Ice Co., and the identity of each of these companies will be merged into the new corporation. The stockholders have elected as directors James E. Furman, N. Fred Avery, Frank Bonnell, H. R. Dickinson, A. B. Knowlson, A. S. Ainsworth. The directors organized by electing as president, A. V. Knowlson, vice-president, A. S. Ainsworth; secretary, James Grant; treasurer, N. Fred Avery. The consolidated company has decided upon a plan for districting the resident portions of the city in a manner to insure the promptest and most satisfactory delivery, and prices will not be increased but instead will have a lower tendency in the way of discounts for cash. By the consolidation the expenses of covering practically the same territory will be obviated.

OBITUARY.

——Orlando B. Titus, North Adams, Mass., died February 22, in his eighty-fourth year. In his early life he was a boatman on the Hudson river, having been born in Richfield, N. Y.; later was engaged in general merchandising in North Adams; and in 1880 he purchased one-half interest in the ice business with J. H. Orr, doing business under the firm name of J. H. Orr & Co. He continued in the ice business until 1892, when, on account of declining health, he sold his interest to J. D. Thyng and retired. His widow and two married daughters survive him. His remains were buried at Albany, N. Y.

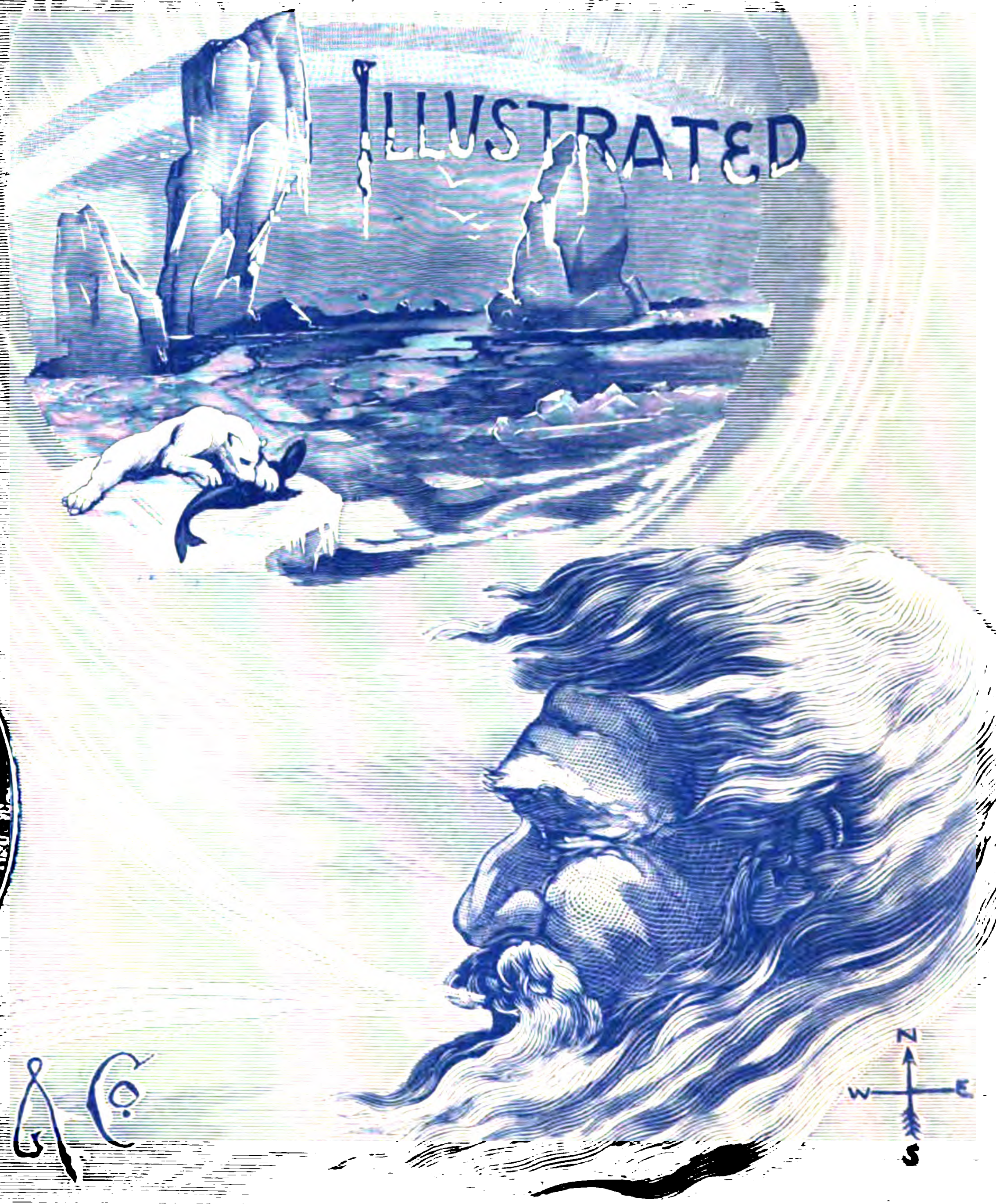
——J. W. Smith, Ottawa, Ont., contemplates erecting a cold storage and freezing plant in that city, and wants information in regard to machinery and methods.

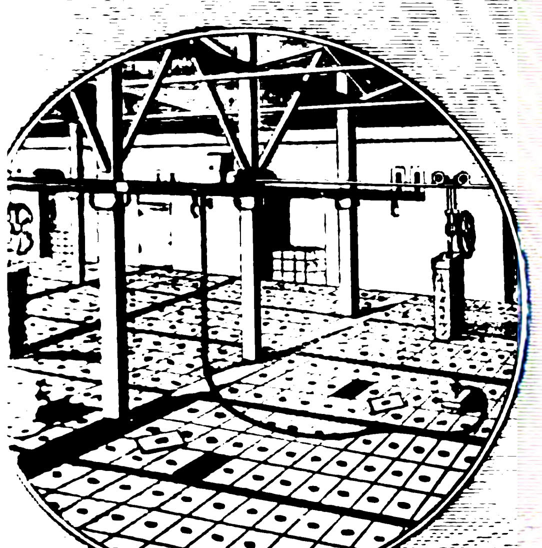
Vol. 6. No. 5.

May, 1894.

Ice and Refrigeration

Illustrated





H. S. Rich & Co.
Publishers
Chicago & New York.

ICE AND REFRIGERATION ILLUSTRATED

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

VOL. VI. NO. 5. CHICAGO : NEW YORK : MAY : 1894. $2.00 PER ANNUM.

[*Special Report for* ICE AND REFRIGERATION.]

SOUTHERN ICE EXCHANGE.

PROCEEDINGS OF THE ADJOURNED MEETING AT ATLANTA, GA.—LIST OF DELEGATES PRESENT—ELECTION OF OFFICERS FOR THE ENSUING YEAR.

THE adjourned meeting of the Southern Ice Exchange was held at Atlanta, Ga., in the parlors of the Kimball house, on April 11 and 12. There was a large attendance, delegates being present from the states of Tennessee, Mississippi, Louisiana, Alabama, Georgia, North and South Carolina and Florida, who represented a total daily ice making capacity of 2,345 tons. The meeting was one of the most successful yet held by the Exchange. Differences between several individual members were amicably adjusted, and the best of good feeling prevailed. Friendships were formed that are sure to deepen and result in much good and to prevent many misunderstandings in the future.

Among those present were the following:

LIST OF DELEGATES.

Edward E. Eagan, Asheville Ice and Coal Co., Asheville, N. C.; P. A. Frercks, Salisbury Ice Co., Salisbury, N. C.; Abe Ellis, Abe Ellis & Co., Columbus, Ga.; Louis P. Hart, Central Ice Co., Mobile, Ala.; J. R. Keller, Stratton Ice Works, Pensacola, Fla.; W. S. Ware, Jacksonville Refrigerator Ice Works, Jacksonville, Fla.; Chas. W. Biese, Lookout Ice and Cold Storage Co., Chattanooga, Tenn.; E. R. Conger, Palmetto Ice Co., Columbia, S. C.; T. L. McComb, Milledgeville Ice Co., Milledgeville, Ga.; Morris Benjamin, Atlanta Ice Co., Atlanta, Ga.; Peter Kern, Knoxville Ice Co., Knoxville, Tenn.; Simon Benjamin, Ocala, Fla., representing the Florida Ice Manufacturers' Association; P. G. Burum, Augusta Ice Co., Augusta, Ga.; Sol Benjamin, Standard Ice Co., Atlanta, Ga.; G. T. Johnson, Athens Ice Co., Athens, Ga.; W. N. Flanders, Piedmont Ice Co., Greenville, S. C.; W. B. Hallett, W. B. Hallett & Co., Spartanburg, S. C.; J. Syd Robbins, Star Ice Co., Selma, Ala.; J. M. Beath, Georgia Ice Co., Atlanta, Ga.; R. C. Graves, Bohlen-Huse Ice Co., Memphis. Tenn.; Frank O. Rettig, Big Spring Ice Co., Chattanooga, Tenn.; W. R. Brown, Columbus Iron Works, Columbus, Ga.; Wm. E. Worth, Wilmington Refrigerator and Ice Works, Wilmington, N. C.; W. J. Rushton, Birmingham Ice Factory Co., Birmingham, Ala.; P. B. Brown, Anniston Ice Mfg. Co., Anniston, Ala.; W. H. Lynn, Crystal Ice Co., Knoxville, Tenn.; W. H. Russell, Emory River Ice Co., Harriman, Tenn.; S. R. Sims, Americus Ice Co., Americus, Ga.; J. E. McBride, Decatur Ice Co., Decatur, Ala.; J. K. Griffin, Knoxville, Tenn.; Wm. B. Miller, Etowah Ice Mfg. Co., Cartersville, Ga.; C. S. L'Engle, Atlanta Crystal Ice Co., Atlanta, Ga.; A. Steiner, Atlanta City Brewing and Ice Co., Atlanta, Ga.; J. Wilczinski, Greenville Ice and Coal Co., Greenville, Miss.; W. J. Graham, Graham Ice Mfg. Co., Johnson City, Tenn.; C. F. Sugg, Huntsville Ice Factory and Bottling Co., Huntsville, Ala.; R. M. Freeman, Greenville, S. C.; Emmor H. Lee, Atlanta, Ga.; J. F. Nickerson, representing ICE AND REFRIGERATION, Chicago.

EDWARD E. EAGAN, ASHEVILLE, N. C.
President Southern Ice Exchange.

The following plants were also represented:

City Ice Co., Augusta, Ga.; Columbus Ice and Refrigerating Co., Columbus, Ga.; New Orleans Ice Mfg. Co., New Orleans, La.; Crescent City Ice Co., New Orleans, La.; Gorrie Ice Mfg. Co., Savannah, Ga.; Avondale Ice Factory, Avondale, Ala.; Central City Ice Co., Macon, Ga.; Acme Brewing Co., Macon, Ga.; Macon Oil and Ice Co., Macon, Ga.; Standard Ice and Fuel Co., Charlotte, N. C.

MORNING SESSION.

The meeting was called to order by President C. W. Biese at 10 o'clock. The minutes of previous meeting were read and adopted.

After some discussion it was moved that a committee of five members be appointed to devise ways and means to place the Exchange on a better basis and to suggest the best methods to adopt for the purpose of strengthening the Exchange. The motion was carried, and the

following committee appointed: L. P. Hart, W. S. Ware, E. E. Eagan, E. R. Condor and M. Benjamin.

The president called attention to the question of ammonia and the advisability of the Exchange establishing a factory of its own; and after a full discussion it was moved that a committee of three be appointed to look into the question. The motion was carried and a committee of three appointed as follows: J. M. Beath, Abe Ellis and Sol. Benjamin.

W. S. WARE: There is one suggestion I would like to make. Mr. Benjamin made the statement that there are a number of tons of sulphate made in this town and shipped to St. Louis. Now, the question under discussion is, Is the increased price of sulphates the cause of the increased price in ammonia? I would simply suggest that the committee find out how much they are giving for sulphates at the present time compared with the past two or three years.

CHAIRMAN: Well, this committee can attend to that. We have appointed two new committees. Is it the desire of the members here that we shall appoint other committees before we adjourn, so that these committees can get to work, or shall we put these first to work and then meet and hear their report? What will you decide on the subject?

J. SYD. ROBBINS, of Selma, Ala., suggested that the question of prices be discussed and arranged.

CHAIRMAN: You have heard the remark of our brother from Selma. I would say, however, that it is a part of the duty of the first committee to bring in something tangible on the subject. At the present time I believe that it would be rather premature to approach that subject; but before we finally adjourn we certainly should speak on that question and decide it. I would state before we adjourn that I hope the members interested in the workings of the first committee of five will call the different members of the association before them to gain information. I desire to say that, if possible, I would like to have the members remain as close to the hotel as it is convenient for them to do, so that they may be called in by the chairman of that committee.

On motion of Mr. Ellis the meeting then adjourned, subject to call of chairman.

AFTERNOON SESSION.

Meeting was called to order by President C. W. Biese at 4 o'clock.

CHAIRMAN: The first in order is the report of the committee on devising ways and means of what is best to be done for the Southern Ice Exchange. The secretary will please read the report.

REPORT OF COMMITTEE.

Your committee that has been appointed for the purpose of inquiring what can be done for the benefit of the interests of the Southern Ice Exchange, has, after diligent inquiry among the members present, come to the following conclusion:

That it seems impracticable for us to undertake the regulation of prices and interfere in the local traffic as far as the price of ice is concerned.

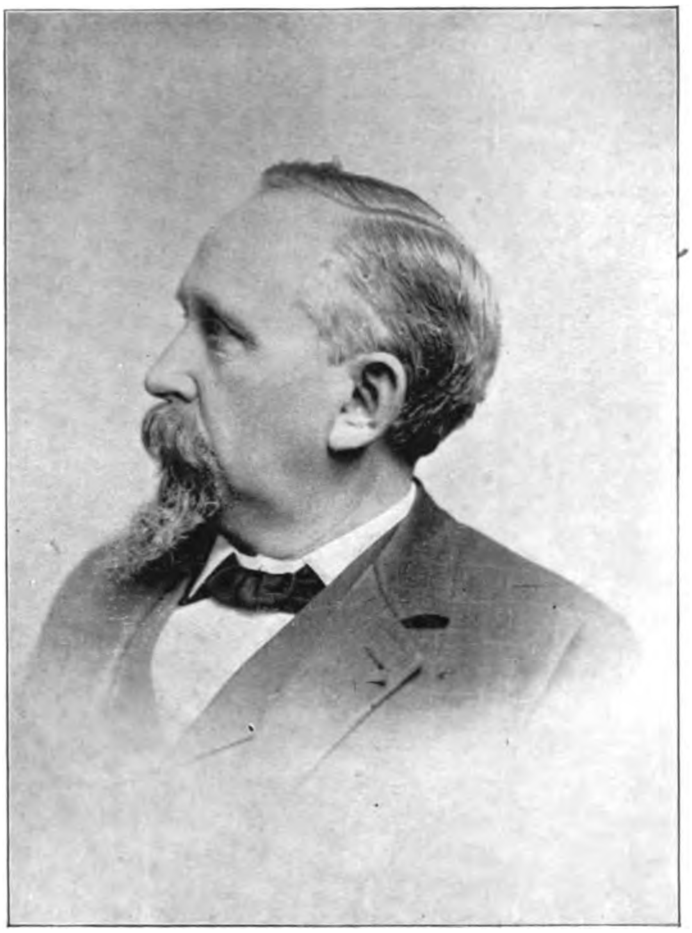
We would advise that the association be kept up as a social one, in order that the members may meet and become personally acquainted with each other, thereby being able to talk over and adjust differences.

We would further advise that we study the most economical means of manufacturing ice, and for that purpose we would suggest that different members of the Exchange be appointed from year to year to bring data on the question of ammonia, distilling of water, managing of hands and wagons, cost of delivery, and everything appertaining to the making and selling as well as the delivering of ice.

We would further advise that, at the meeting of the association, the members that come in competition with each other in the shipping of ice should regulate the price that they mutually wish to ship ice for.

It may be to the advantage of the association to create a fund that may be used in cities, if it is deemed practicable, where there is trouble arising from breweries or other concerns. We would suggest that the fees be $10 for each factory or company; and if it is decided to make or create a sinking fund for the aforesaid purpose, then an additional amount for tonnage be charged to each manufacturer.

(Signed), LOUIS P. HART,
W. S. WARE,
E. R. CONGER,
E. E. EAGAN,
Committee.



R. C. GRAVES, MEMPHIS, TENN.
Vice-President of the Southern Ice Exchange.

CHAIRMAN: You have heard the report of the committee. What is your pleasure? Do you want to adopt it as a whole, or talk over the matter? I would like to hear from the members of the association with reference to this report.

MR. RUSHTON moved the report of the committee be accepted as a whole.

MR. BURUM moved that the clause relating to a "sinking fund" be left out.

MR. HART: It seems to me that a better plan would be, if the gentlemen do not like the "sinking fund" portion, that it be accepted merely as a suggestion. It seems to me that something ought to be done in regard to this $10—that part should be acted upon. This convention calls together a great many members, but the Exchange is not supposed to regulate anybody's business. We merely wish to discuss and protect the manufacture of ice, and we hope that all of us will gain some knowledge.

MR. RUSHTON made a motion that each factory pay $10 to a general fund, to be expended for such purposes as were necessary. He also made a statement that the members might meet each year and from the fund provided have a quiet little supper, etc.

MR. KERN: Without funds we cannot do anything; we must have a little money in the treasury. I second Mr. Rushton's motion.

MR. BURUM moved that the fee be made $5. He also stated that he was willing to make it a social feature, and

said that he felt sure a supper, etc., would not cost more than that.

MR. GRAVES: I do not think there will be any harm in keeping such a fund on hand. If we cannot pay $10, do not pay anything.

MR. HART: We have by-laws in this organization, which I believe give the executive committee charge of any funds on hand. I think the present treasurer is under bond.

MR. M. BENJAMIN: I desire to state for the benefit of the members that the committee on ammonia has a report to make, and I only want to say this, that in pursuance of the information contained in that report there will be some funds needed.

MR. ELLIS made a motion that the report of the ammonia committee be read before further action be taken as to the amount of dues to be charged.

The question being called for, the motion was carried that the fee be $10, as formerly provided for in the by-laws.

CHAIRMAN: I would now like to hear the report of the committee on ammonia.

The secretary read the following report:

REPORT OF COMMITTEE ON AMMONIA.

Your committee on ammonia beg to report as follows:

The means of finding out the cost of material and requisite machinery necessary are not at hand, nor can they be obtained within the time allotted for the deliberations of this convention; therefore

We recommend the appointment of a permanent committee to fully investigate and report to the executive committee of the Exchange at some future meeting, called for the purpose of considering such report.

It is further recommended that the Southern Ice Exchange, at its present meeting, set aside a sum of money, subject to the demand of said committee, sufficient to cover all expense incurred by them in obtaining the information sought.

It is further recommended that the present committee be discharged.

(Signed,) Very respectfully,
J. M. BEATH,
M. BENJAMIN,
ABE ELLIS,
Committee.

C. F. SUGG, HUNTSVILLE, ALA.
Secretary and Treasurer Southern Ice Exchange.

CHAIRMAN: What is your pleasure as to the report?

MR. GRAVES moved that the report be adopted as read, and that a committee of three be appointed.

CHAIRMAN: It is now before you for discussion.

MR. GRAVES: I have not been before this committee, but I think it is well that we take the matter up. I doubt the probability of our undertaking to build ammonia works, owing to the fact that the machinery is rather expensive and it is out of our line of business; but I think there should be a permanent committee appointed upon this question to keep it all in mind and learn all about the manufacturing of ammonia, so that if we afterward go into business, we can do so intelligently.

CHAIRMAN: I think that Mr. Graves' ideas are very much like mine. It is a very good thing to keep this matter before us and have a permanent committee for that subject. They may act in such a way that it would be beneficial to the association and members.

On motion, the convention then went into executive session to consider the ammonia question, during which a motion was passed that a permanent committee of three be appointed as recommended, and that an amount not to exceed $100 be appropriated, the expenditure of which should be left to the discretion of the committee.

CHAIRMAN: If there is any further matter to be brought before the Exchange, I would like to hear from the members; if not, I will read a letter directed to me as president of the Southern Ice Exchange. On re-assembling in open convention, the president laid before the meeting the following letter and resolutions received from the Florida Ice Manufacturers' Association:

PALATKA, FLA., April 9, 1894.

CHAS. W. BIESE, *President Southern Ice Exchange:*

Dear Sir.—The inclosed preamble and resolutions were adopted at our annual meeting in March. If your association could meet with us, arrangements could be made for reduced rates, and it would be at a time when your members could easily visit Florida, which no doubt would afford them a double purpose—a pleasure and business trip.

Yours very truly,
L. C. CANOVA, *Secretary.*

RESOLUTIONS.

WHEREAS, The Southern Ice Exchange and our Association being of the same interest and purpose, *i. e.*, the development and advancement of the ice industry, the protection of their members from impositions and indiscriminate cutting, and finally the cementing of ties between members, making them friends and brothers and

WHEREAS, An arrangement by which the members of the two associations could meet in general conference would be of much greater benefit to individual members and of much greater benefit to the associations; therefore be it

Resolved, That the Southern Ice Exchange be earnestly and cordially invited to hold their next annual meeting in Jacksonville, Fla., on the second Wednesday in February; be it further

Resolved, That after transacting their regular business, the two associations meet jointly in general conference and discuss matters of mutual interest and benefit.

Resolved, That the secretary forward to the president of the Southern Ice Exchange a copy of the resolutions.

L. C. CANOVA,
Secretary.

MR. SIMON BENJAMIN: As a member of the Florida Ice Manufacturers' Association I want to say for the benefit of the gentlemen present that we have a number of plants in the state, but they are all small. Our last meeting was held in March at Stafford, and our next meeting will be in Jacksonville. We think it would be well for the Southern Ice Exchange to meet at the same time and place. We have suggested the second Wednesday in February to conform with the time set for your meeting. This is a splendid time of the year to meet in, and I believe the railroads will give very low rates. We would like you to see Florida, and also inspect our mode of manufacturing ice.

CHAIRMAN: What is your pleasure as to this invitation?

MR. GRAVES suggested that the matter be held over until the next day, in order to permit others the privilege of presenting invitations.

CHAIRMAN: I think it would be a very proper way of disposing of it by referring this matter to a special committee and hear their report to-morrow; that gives the committee ample opportunity to consider the matter.

It was moved and seconded that the chair appoint a committee of three to act upon this matter, also to receive invitations from any other cities, and report next day.

CHAIRMAN: I appoint on this committee Mr. J. Wilczinski, from Mississippi; Mr. Frank O. Rettig, from Chattanooga, and Mr. Sol. Benjamin, of Atlanta. We have some papers here that may be of great interest; in fact, I know they are of great interest to all of us. They were written by Prof. J. E. Siebel, of Chicago, at the request of the publishers of ICE AND REFRIGERATION with

J. WILCZINSKI, GREENVILLE, MISS.
Chairman Executive Committee Southern Ice Exchange.

a view to exciting discussion and calling attention to that very desirable feature of our association: of the reading of such papers at our meetings. The paper is entitled "Incidents and Accidents in Refrigeration." Some one has suggested that we lay these papers aside until the evening meeting and read them after supper. As we are to have a meeting after supper, I would like to hear from the Exchange what you desire to do upon that subject.

MR. GRAVES suggested that the Exchange wait until the evening session.

CHAIRMAN: We will leave them until this evening. If there are any further matters to be brought before the Exchange, I would like to hear from you.

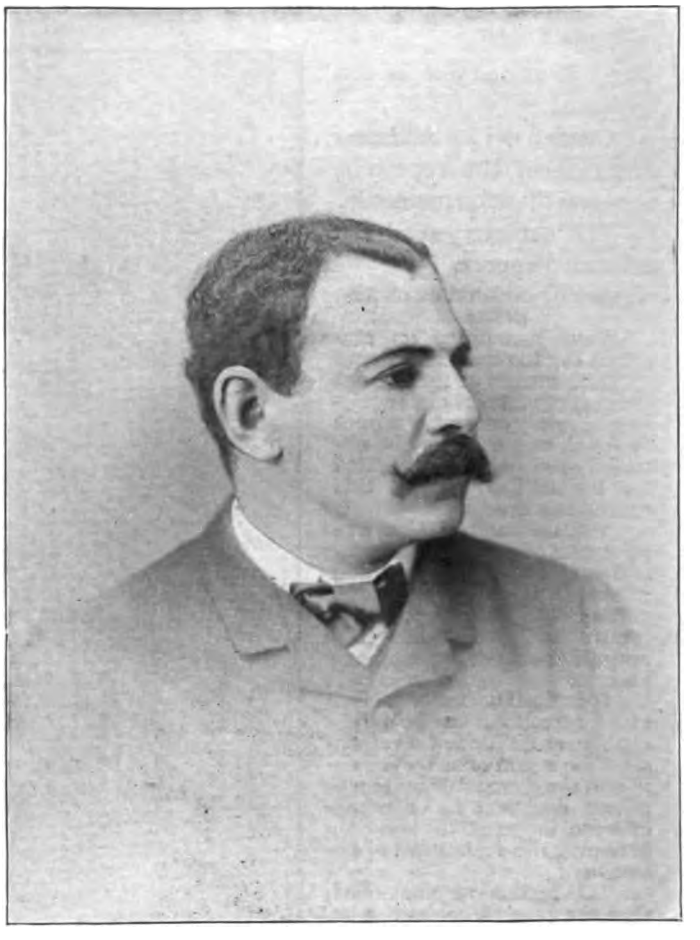
MR. WARE: I think February is a bad time to hold our meeting, as most of the manufacturers are right in the midst of their overhauling. I would simply suggest, that being the case, and it is deemed wise by the Exchange, that another date be made other than that which has already been set; and, I think I can vouch for the Florida organization, if you see fit come down to visit us, that we will change our meeting to suit that date.

CHAIRMAN: I am very glad that Mr. Ware, of Florida, made these remarks. I heard a number of members say that February was a bad month. I would suggest that we have an earlier meeting.

MR. GRAVES: I do not think it ought to be before the 1st of February, or later than March. February will suit almost every one.

CHAIRMAN: Is there anything further that the members of the Exchange wish to bring before this body?

MR. GRAVES: I do not know but that it would be a good plan to expend a little of our money in making



MORRIS BENJAMIN, ATLANTA, GA.
Member Executive Committee Southern Ice Exchange.

some tests of the different kinds of oil. I do not know that there would be anything beneficial in it, but a committee could obtain data that we could probably use at our next meeting.

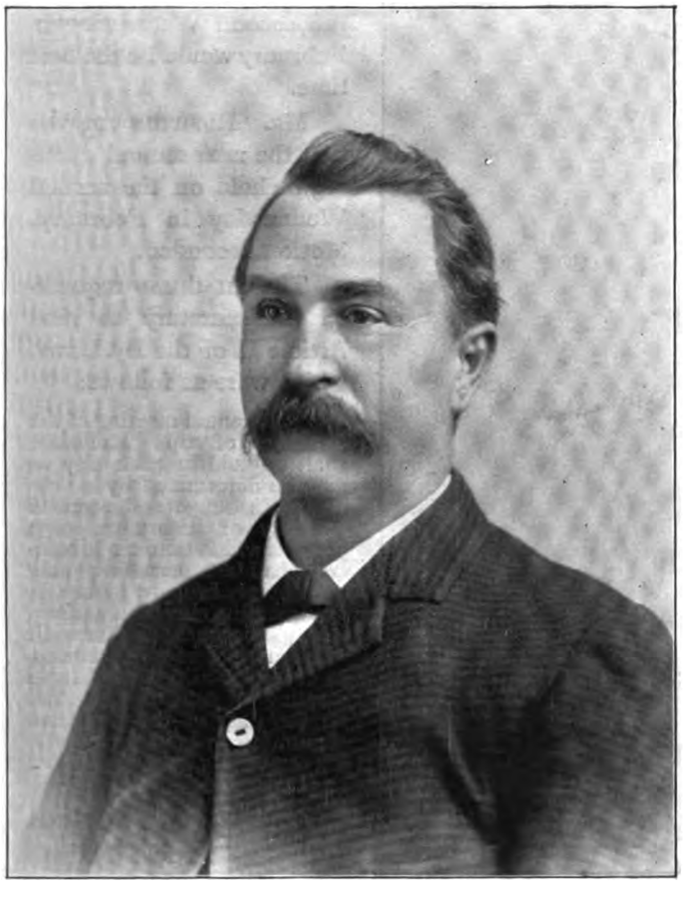
CHAIRMAN: I think that it would be a great deal better to select a committee, some one member to prepare a paper on the subject of oil, to be read at the next meeting, as well as on other subjects, as recommended by the committee.

After some discussion it was moved and carried that President C. W. Biese be requested to write an article on the subject of "Distillation of Water"; Mr. R. C. Graves one on "Oils"; Mr. W. J. Rushton on "Ammonia"; Mr. Louis P. Hart on "Delivery of Ice"; Mr. Wm. E. Worth on "Storage of Ice"; and Mr. E. R. Conger on "Fuel and Steam."

COUPON BOOKS.

CHAIRMAN: Some of our ice manufacturers have adopted the system of coupon books, and some think that it is not the proper way of disposing of their product. I would like to hear from some of you on that subject. We have here ice manufacturers from all over the South, from Louisiana to Tennessee. If there is any one present who would like to talk upon the subject, I would be glad to hear from him. Perhaps Mr. Benjamin, of Atlanta, can give us some information on this subject.

MR. M. BENJAMIN: We have been using the coupon books for years, and have found it a very satisfactory way of doing business. It does away with a great deal of bookkeeping. It makes the customer pay for what he does get, and does not require him to pay for ice that he does not get. Since I have been in the ice business we have used the coupon books, and we charge in accordance with the amount of ice delivered. Every book is numbered, and every coupon is numbered. I will take pleasure in showing any of the gentlemen our system; furthermore, I will bring one of our books up here and explain more fully how it is worked. We require some parties to pay cash, while of course, the responsible ones are credited.

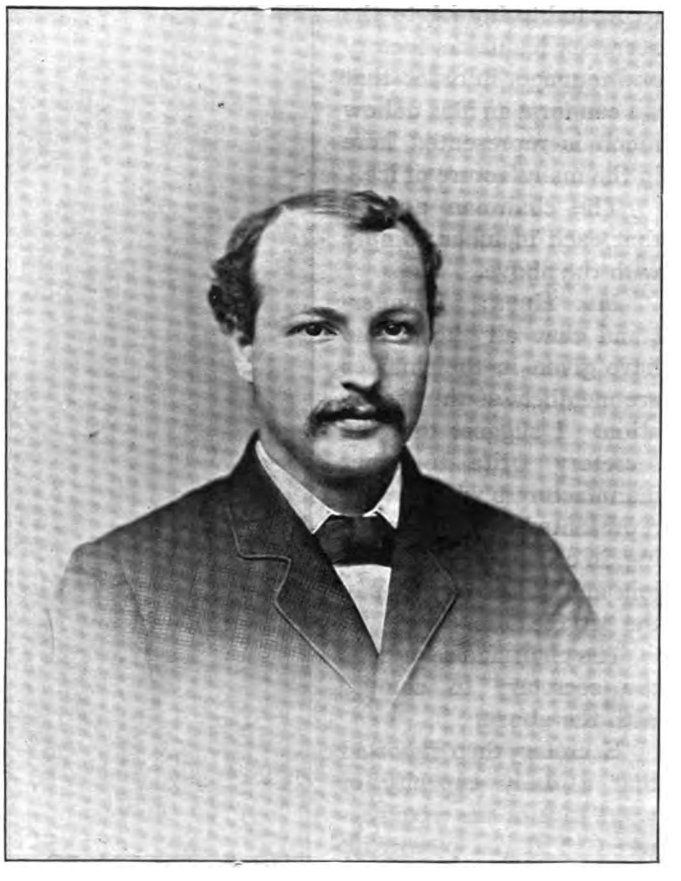


PETER KERN, KNOXVILLE, TENN.
Member Executive Committee Southern Ice Exchange.

MR. RUSHTON: A great many consider that a strictly cash business is what Mr. Benjamin is doing. I do not think that it is best to make a strictly cash business of it, as I would not want to require a responsible man, who settles promptly, to pay spot cash.

MR. FLANDERS: When I started in the ice business, we had no coupon books. I went around and got samples of all the books I could find. I had an idea that the ice business should be cash, so I went to work and made a book, each coupon of which calls for five cents' worth of ice; these books I sold for cash. Since then I have had no trouble at all. This is the third year I have been running by the coupon book system. Before then every month there would be from $500 to $600 to be collected, and it would keep the entire force busy collecting. If our drivers return sixty cents or seventy cents per hundred pounds we are very well satisfied.

MR. SOL. BENJAMIN: If the committee which is going to secure information to be read at the next annual meeting will enlighten me as to how to keep even with the drivers, they will help me along very much. I do not think there is any way to keep even with them. He drives up very early in the morning, and invariably has several blocks of ice stored away in the wagon before you can count them. The result is that the driver is going to check up all right with you in the evening, and still have his little pocket change.



ABE ELLIS, COLUMBUS, GA.
Member Executive Committee Southern Ice Exchange.

CHAIRMAN: In reference to the coupon system, I want to state that in our city we adopted the plan of the pound coupon system. One of my salesmen gives out a coupon book. In the front of that coupon book is a receipt, which says: "Received of the Lookout Ice Co. one coupon book calling for 1,000 pounds of ice, for which I agree to pay so much." The customer signs that receipt. His name is noted opposite the number in the registry, the date that the coupon book is sold and when it is paid for. That receipt is the same as a note. I hold them in my possession, and they are in such a shape that I can sue for the money if they fail to pay, as they cannot dispute the fact that they promised to pay so many dollars. I see the point in the "cash system," and think I shall adopt that plan in addition to the one I already have. I have found it necessary to be very strict in our cash business.

MR. KERN: In Knoxville we sell tickets calling for a certain amount of ice. I have sold about 90,000 tickets since I have been in the business, possibly more. I have three drivers. If they average me a certain per cent the year round I am satisfied. My present drivers have been with me for three years. On Christmas I divide $100 among them in this way: The one who has the highest average gets $50, the next highest $30, and the other $20. In regard to having tickets printed, I generally have about 2,000 printed at one time. I have to have the work done away from home, as a good many of the printers are not honest. I am sure that I make money by using them. I sell a great many more tickets than are returned, as they lose a great many. I should say about three-fourths of them come back.

MR. RUSHTON: Mr. Ellis has made a very good suggestion to me. It is that each gentleman present be requested to furnish to the secretary his name, factory and tonnage, in order that we can form an idea of how much is represented here in the manufacture of ice.

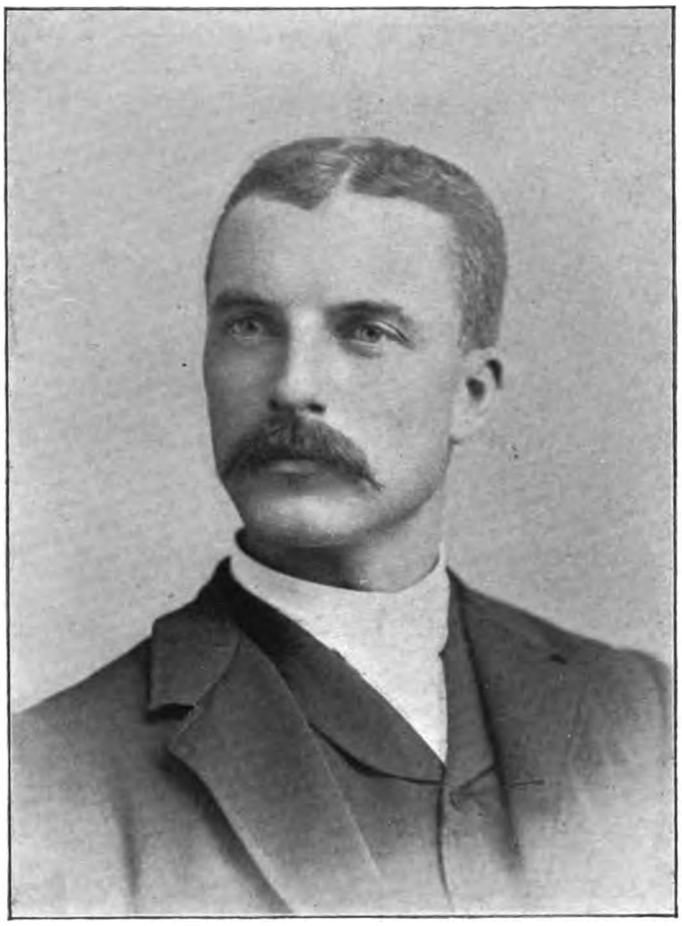
The chairman asked that each member comply with the above.

MR. KERN: I understand that all those who have given in their names are members of the association. I suggest that the secretary write to other manufacturers who are not represented in this meeting, in order that they may join and be allowed to pay the $10 fee.

The chairman requested the secretary to comply with the above.

Secretary then reported that a daily capacity of 1,721 tons of ice were represented at the present meeting. This was later increased to 2,345 tons.

The meeting then adjourned until 8 P. M.



E. R. CONGER, COLUMBIA, S. C.
Member Executive Committee Southern Ice Exchange.

EVENING SESSION.

Meeting called to order by the president. Secretary was requested to read the report of the committee appointed to select a place and time for the next meeting. The report was as follows:

To the officers and members of the Southern Ice Exchange: Your committee, appointed to select a suitable place and time for the next annual meeting, hereby respectfully recommend the acceptance of the kind offer contained in the resolutions of "The Florida Ice Manufacturers' Association," to meet in the city of Jacksonville. In regard to the date, in order to meet the convenience of the members, we suggest any Wednesday from the third Wednesday in February to the last Wednesday in March, 1895, and recommend that this be fixed by vote. Also, that the thanks of this Exchange and the acceptance of the offer be spread on the minutes of this meeting, and the secretary be instructed to advise the Florida Ice Manufacturers' Association of this action. (Signed),

J. WILCZINSKI,
FRANK O. RETTIG,
SOL. BENJAMIN,
Committee.

CHAIRMAN: You have heard the reading of the report of the committee.

MR. GRAVES: I would have been glad to have the Exchange hold their next annual meeting at Memphis, but I move that the report be adopted. [The motion to adopt the report of committee was carried.]

MR. M. BENJAMIN made suggestion that the members agree as to what Wednesday would be acceptable. Said he would suggest to the Florida association that they meet one or two days ahead, as it would be conflicting if both associations met the same day and hour.

MR. RUSHTON: At our first meetings it was our endeavor to fix prices, and for that reason we wanted to have an earlier meeting in order to be ready for the coming season, but now, since we do not have to do that, it does not make any difference about holding the meeting earlier.

MR. GRAVES: I think the second Wednesday in February would be the best time.

MR. RUSHTON moved that the next annual meeting be held on the second Wednesday in February. Motion seconded.

The CHAIRMAN requested the secretary to read Article II of the By-Laws, which were as follows:

The annual meeting of the members of this Exchange shall be held in such city as may be determined by a vote of this Exchange on the second Tuesday of February, each year, at which time such business shall be transacted as may be properly brought before it. Said meeting may be adjourned to any subsequent day for want of a quorum, or other causes. In case of a failure to hold said meeting at said time, it shall be the duty of the executive committee to hold such meeting at as early a day thereafter as practicable.

SECRETARY C. F. SUGG moved that Article II of By-Laws be changed to read "second Wednesday," instead of "Tuesday." He stated that Tuesday was a bad day in which to get anywhere, from the fact that it necessitated a majority of the members leaving home on Sunday.

CHAIRMAN: You have heard the motion to amend the By-Laws, and that we meet and hold our next annual meeting in 1895 on the second Wednesday in February, at Jacksonville, Fla.

The motion was seconded and carried.

MR. RUSHTON moved that a committee of three be appointed to bring in names of the officers for the ensuing year. The motion was carried. The chair appointed the following: Messrs. Rushton, Ware and Lynn.

AS TO PRICES.

MR. P. B. BROWN stated that he thought the question of prices should be discussed; said he was aware the Exchange was not authorized to make prices, but they

could certainly discuss them. He said he thought that no one should ship a single sack of ice for less than fifty cents, and told of one factory that shipped within twenty-six miles of him and charged thirty-eight cents per 100 pounds, less twenty-six cents freight, netting them twelve cents for the ice. He said he did not know whether there was any one present representing this factory, but that he had letters from them asking him to agree not to ship ice to an outside town for less than fifty cents per sack; at the same time they were shipping it for thirty-eight cents.

ELECTION OF OFFICERS.

The report of the committee on the nomination of officers was then read by the chairman, Mr. Rushton, as follows:

Your committee place in nomination for officers of the Southern Ice Exchange for the ensuing year:
E. E. Eagan, Asheville, N. C., for president.
R. C. Graves, Memphis, Tenn., for vice-president.
C. F. Sugg, Huntsville, Ala., for secretary and treasurer.
Arbitration and executive committee: J. Wilczinski, Greenville, Miss.; Abe Ellis, Columbus, Ga.; E. R. Conger, Columbia, S. C.; Morris Benjamin, Atlanta, Ga.; Peter Kern, Knoxville, Tenn.

MR. BURUM moved that the secretary be authorized to cast one ballot for the entire list of officers nominated by the committee. Motion was carried and ballot cast by the secretary.

MR. BIESE then invited Mr. Eagan to the chair.

PRESIDENT EAGAN: I regret very much the action you have taken, and think you have made a mistake; perhaps in after years you will realize that you have. I am sure that some other member who has a larger interest in the manufacture of ice than I should occupy this position; but with the help of those who have been chosen as the other officers, as well as the executive committee, I am willing to do all that is in my power to aid the association, and I trust that when we next meet more good may be realized from hard work on the part of all of us during the coming year than we have accomplished in the past. I think that all of us, if we will put our shoulders to the wheel, can make good progress in the interests of the Exchange during the coming year.

At the request of the chair, Mr. Rushton then read the article on "Incidents and Accidents in Refrigeration," prepared by Prof. J. E. Siebel, director of the Zymotechnic Institute, Chicago, which was very interesting and greatly enjoyed by every one present. It was moved and seconded that a sufficient number of copies be printed for distribution to all of the members of the Exchange, but this was withdrawn on the suggestion that the paper would be published in ICE AND REFRIGERATION, the official organ of the Exchange. On motion of Messrs. Graves and Rushton, it was moved and carried that a vote of thanks be extended to Prof. Siebel, and to ICE AND REFRIGERATION for the very interesting and valuable paper. [This paper will appear in these columns in a later issue.]

Messrs. RUSHTON, CONGER, WARE, ELLIS and others spoke at length in regard to the color of ice, cores, rusted pipes, boilers, etc., and each subject treated on by Prof. Siebel was fully discussed.

MR. JOHNSON related his experience with ammonia. He said his plant was built in 1891, and before the close of the season he noticed that the ammonia was corroding the pipes. He said: I realized at once that it was getting to be a serious matter, and that something ought to be done immediately. I took a sample of the ammonia from our machine and went up to see Prof. White, and had him make an analysis of it, and also had a talk with him on the subject. He said at once that there was some impurity in the ammonia which caused the trouble. After making the analysis he said it contained some chloride of potassium. He advised me to use about five per cent of slack lime in the retort, which I did, and am sure that I have been benefited by it. I ran through the entire season without any corrosion whatever.

MR. LYNN, from Tennessee, stated that his water was good and pure, and, therefore, he never experienced any trouble with colored ice.

MESSRS. WORTH, BENJAMIN and RUSHTON all made lengthy statements in regard to their experience with colored ice, coils, etc.

IMPURE GASES.

MR. ELLIS discussed the question of impure gases quite fully. He stated that he had found that the best way was to burn it off. The result was that he did not find it necessary to re-charge with ammonia from April to December, and at one time he did not have to put ammonia in during a period of eighteen months. Mr. Ellis further said that he had never burned off the gas for more than fifteen minutes.

MR. WORTH stated that about two years ago he bought fifteen drums of ammonia and put it into his machine, and on the second day undertook to burn off the gas, and that it burned for five hours.

MR. BIESE: Since last year I have bought my ammonia from good, responsible people, and have realized much better results.

The CHAIRMAN appointed the following committee on ammonia: Messrs. W. S. Ware, C. W. Biese and Sol. Benjamin.

MR. M. BENJAMIN moved that the convention adjourn.

MORNING SESSION, APRIL 12.

Meeting called to order by President Eagan at 9:45.

The CHAIRMAN suggested that members discuss the subject of social relations, as mentioned in the report of the committee.

MR. GRAVES said that he thought the social feature a good one, and that the members ought to stick together like men on a jury.

PRICES AGAIN.

MR. P. B. BROWN: In regard to the social relation, while that is an important and desirable feature, it seems to me that there could be nothing better for the interests of the association than to discuss the regulation of prices. The public wants ice. If you price it to them at fifty cents, they want it for forty cents; if you price it at forty cents, they want it for thirty cents; and if you price it at thirty cents, they want it at twenty cents. They take the privilege of writing to me that a man over in Selma offers it for thirty cents. Now, what shall we do? Surely we should write to each other. If we get together and compare notes, we can arrange prices and the public will not suffer.

MR. WARE: I think that that matter is very easily solved. In the first place, we are compelled to have confidence in our competitors; we must have confidence in them, to begin with. If a man comes to me in Jacksonville, as men do every day, and says, "I want to get ice for a refrigerator line; what will you sell it to me for?" my answer is that I will give him all he wants in his cars for $5 per ton. He states, "I can get all I want for $4." "Possibly you can," I say; "but I cannot

afford to sell for that." Now, when we get down to our retail trade, we simply divide our territory along the line of railroads, and each man ships in his own territory. The territory is divided by the miles of rail. If a man from my territory writes to my competitor, he immediately returns that letter to me, and, of course, I do the same toward him. He will quote him prices that our association has adopted, and say, "I will sell you ice for such a price, but refer you to Jacksonville, for they can do better. He is nearer the railroad, and freights are in his favor." Now, in that way we keep up a unanimity among the manufacturers. I think we are all "toting fair." I do not believe that there is a single man in our association who is trying to get into another's territory, and I base that on the fact that we have confidence in one another. In regard to shipping in refrigerator cars—we are charging $5 per ton. I have a contract with three companies in Florida at $5 per ton. Since I have been in this meeting I was surprised to hear that ice is being sold in car load lots at $3 per ton. I tell you it cannot live. I would like some gentleman who is selling ice at $3 in car-load lots to give me a good reason for it. I would not make it if I could not get more than $3. I have reference to the central plants where they do not come into competition with the natural product. I see no reason why we cannot get $5 per ton. In regard to the plants outside of this association—these people, not connected with this organization, will ship ice to towns not in their territory, and I think we ought to get these people into our Exchange. If this association would work it right, I think we could get all of these plants in. It is easier to coax them than to drive them in. I have been looking over Ice and Refrigeration and I find that our prices compare favorably, but at the same time there is a downward tendency all the time. You know as well as I that an ice factory that cannot make 20 per cent profit on its investment, providing it does not take anything out for a sinking fund, is not making very big money. It must make 20 per cent unless it takes out for a sinking fund; they cannot make money on a less per cent. I have spent not less than $6,000 or $7,000 for what I call extra expenses. I would like to have some one give a reason why central factories should sell ice for $3 per ton. I can see no reason why it should be done.

Mr. Rushton suggested that it was the "other fellow."

Mr. Ware: Then we must handle the "other fellow"; we are not children; I am in the business to make money.

Mr. Rushton suggested that the "other fellow" was probably a new ice man; that he had not yet been through the mill. He can very easily afford for the first year or two to sell ice for $3 per ton, because up to that time he has not had any experience in regard to bad leaks, etc.

Mr. Ware: For five consecutive years I find that I paid out $3.85 per ton for making and delivering ice. That includes the ice in car loads and what I have delivered. I had rather sell ice at the factory at $3 per ton than to deliver it for $8 per ton. In 1887, which was an extraordinarily good year, my car-load ice ran up to the neighborhood of $7,000 or $8,000 for that one year. Since that year the car-load quantities have reduced considerably. The capacity of my machine is forty-five tons.

Chairman: We want to hear from those present of their opinion about one factory shipping ice into another town when there is a factory located in that town. I think we could all give our experience in regard to shipping ice to another place.

Mr. Graves: I think Mr. Rushton can give us some points in regard to that. All the large concerns in Chicago, Milwaukee and St. Louis have gone through the very same trouble that we are going through now.

Mr. Ellis: I feel that this $3 business is a sort of a cut at myself, and I want to say a few words on that subject. I do not know that I can make myself sufficiently clear to be understood. I think every man in the business has a right to make his own prices, and if he makes the price and loses money by it, he is the only sufferer. "The other fellow" is not compelled to follow, and the great trouble with all the manufacturers is that the small firms endeavor to force the local price too high. I sell ice for $3 per ton, and I think I know what I am doing.

Mr. Robbins made complaint that Birmingham was shipping, or was about to ship, ice into his town at a reduced price and thereby ruin his trade. He stated that Montgomery, Mobile, Selma and Meridian had always had an arrangement that they would not ship ice out of their territory. One of the companies in Alabama, I understand, has offered to ship ice anywhere at a price of $3 per ton. We sell ice in Selma at a cheaper price than it can be had in Mobile, Montgomery, Meridian, and all of the smaller places, with the exception of Birmingham. The Birmingham people are going to ship ice to my town. Of course it will amount to one of two things. The local factory will either have to submit to it and meet his prices in order to hold their trade, or they will have to drop out. What is the result? The price is cut; they ship two or three car loads, and then the prices become demoralized and they quit. The season is about half gone; the prices are cut down, and it is impossible to get them back again, and the local trade is ruined. He said that he had had an opportunity to ship ice to Birmingham, but had not done so.

Mr. Ellis stated that he charged thirty-five cents per 100 pounds for all ice delivered wholesale and retail. He said the cheapest ice he sold was the thirty-cent ice; and that was when the customers called for the ice themselves and his delivery wagon did not have to be used.

Mr. Biese asked the gentlemen to give him some information in regard to the cost of the manufacture of ice. He said he had his expense account itemized as labor, oil, ammonia, fuel and the repair of machinery; he also said that he counted in insurance.

Mr. Ellis said that everything you have to pay out counts as the cost of manufacturing ice.

Mr. Wilczinski said that he had always divided it into two items, one for selling and the other for manufacturing.

Mr. Rushton stated that his company had decided to sell ice this year at $3.05 wholesale. He said he had figured that he would make a small profit after deducting all expenses. He said it was $1.05 when you sell $3 ice, and $3.05 when you sell $5 ice. Mr. Rushton said that he was willing to meet Mr. Robbins anywhere at any time and talk over the matter in regard to shipping ice to his city; that his company had received

an order for ice from a proposed dealer in Selma, and that he sold the ice delivered in Birmingham.

MR. BENJAMIN did not believe in high or low prices, but believed in fair prices; he said he had always fought high prices.

MR. GRAVES said that every one should stand shoulder to shoulder, as when they persist in pulling against each other, that eats up both concerns. Each factory should help the other, and that they should endeavor to raise the standard of the business. He stated that he had been in the business thirty years, and had come to the conclusion from his years of experience that it was best to keep in harmony with competitors.

MR. M. BENJAMIN: We have had quite a lengthy discussion upon this subject, and it has got down to this: It seems to be the sense of nearly every member of the Ice Exchange that is represented here this morning not to ship to any other town that has a factory of its own. As far as Atlanta is concerned, we have about the largest surplus of ice of any town represented here, but we will not make prices and ship into any town that has a factory, especially those who are members of the Exchange, although we are called upon very often to do so, and I hope that will be the sentiment of every one.

MR. ELLIS: I always quote ice at such a price as to protect the factory in the town from which the call comes.

MR. BENJAMIN: I would suggest that inasmuch as our next annual meeting is to be held in Jacksonville, our secretary kindly invites Mr. E. W. Codington, of Bartow, Fla., who is president of the Florida Ice Manufacturers' Association, and who has had considerable experience, to bring in a paper on the subject of what brings the most benefit to the association. He is a very able man. Upon motion of Mr. S. Benjamin it was adopted that Mr. Codington be invited to bring in a paper regarding the "best action to be taken for the benefit of our association."

CHAIRMAN: My territory is so situated that I cannot afford to sell ice as cheap as Mr. Graves or Mr. Ellis. Our season is very short, and unless we have the field all to ourselves, there is very little money in it. My price is forty cents per cwt. I do not know of any ice concerns in the country who are getting very rich.

MR. GRAVES stated that the manufacture of ice ought to be largely increased, and the business raised to a higher standard.

MR. ELLIS agreed with Mr. Graves that we ought to build up the business. He did not think that the members of this convention should openly declare that they would not ship to another territory, but that they ought to be willing to take one another's word for it.

MR. JOHNSON stated that we ought to come to some definite conclusion in regard to the question of prices and territory. He said, "If we leave this meeting with such difficulties as between Birmingham and Selma unsettled, then the Exchange will probably go to pieces. We should certainly hold together. And unless something is done, when we get home and take up our personal duties, we will feel that very little has been accomplished in this convention, and will not feel like going to the expense and taking time to go to the next meeting.

MR. ELLIS said that Mr. Johnson seemed to have very little faith in the members present. If we will have confidence in and depend upon the members doing what they say they will do, I see no reason why we should not get along all right.

MR. RUSSELL, from Tennessee, said that he was not a practical manufacturer of ice, and had, therefore, kept silent. He represented a small ice plant up in the mountains. It was not his choice, but he had been compelled to take it as a debt. He said that the ice factory business should not be a cut-throat business, and that a committee of arbitration should be appointed to arbitrate such difficulties as those between Birmingham and Selma. He thought something should be done toward forming a combination of all the ice factories in the South, which he believed was feasible, same as in other lines of businesses. He gave as an illustration the experience of the tack factory trust, with which he was personally familiar.

MR. GRAVES did not agree with Mr. Russell, as he did not think a tack factory could be compared with an ice factory.

MR. M. BENJAMIN took up the question in regard to the committee appointed on ammonia, who had been commissioned to gather information and report at the next annual meeting held in Jacksonville, in February. He said that he did not think $100 was sufficient to make the necessary inquiries with. He made motion that the amount be increased to $250.

MR. ELLIS said that he did not think it a good idea to expend so much money, but that he was willing to put the matter before the executive committee and let them make such further appropriation deemed necessary.

MR. SOL. BENJAMIN said that he was one of the committee, and he thought the members could trust the committee with as much as $250, and that they would not expend any more than was absolutely necessary.

After some further discussion, the amount at the disposal of the committee was left at $100.

The following resolution was then offered and read by the secretary:

Resolved, By the members of the Southern Ice Exchange in convention assembled:

That we most heartily indorse the proposed Cotton States and International Exposition to be held in Atlanta, Ga., from September 1 to December 1, 1895, as worthy the earnest and united effort of every citizen, business organization, community and state of our common country, as the Exposition is in no sense local, but will result in great good to all sections and in enlarging our foreign trade, especially with Mexico, the Central and South American countries and the West Indies. We pledge the Exposition management our united support. Be it

Resolved, That we urge upon congress to pass the bill before it, providing for a government exhibit. Be it further

Resolved, That the daily papers in Atlanta, and the press generally, be requested to publish these resolutions.

MR. RUSHTON made motion that the resolutions be adopted unanimously. Motion was carried. It was also moved and seconded that a vote of thanks be extended to the proprietors of the Kimball house for their courtesy in extending to the Exchange the use of their parlor as an assembly room; and for the courtesies shown to the individual members of the Southern Ice Exchange.

The convention then adjourned *sine die*.

AN artificial ice palace will be built in Baltimore and opened for skating on June 1. "As a means of propagating pneumonia in those who are foolish enough to enter it suddenly from the outside air it will be unrivaled," says an exchange. Our Canadian friend is talking "through his hat," so to speak, as the facts do not by any means agree with his theory, which was exploded as long ago as 1879 by T. L. Rankin in Madison Square Garden, and now daily in Paris and San Francisco.

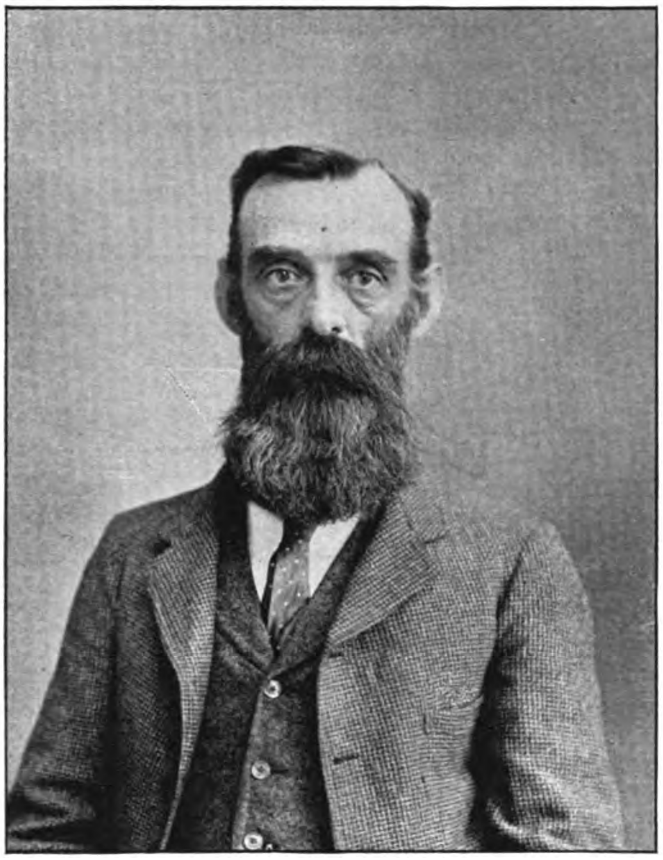
[*Special Report to* ICE AND REFRIGERATION.]

ASSOCIATION MEETINGS.

ANNUAL MEETING OF THE SOUTH-WEST ICE MANUFACTURERS' ASSOCIATION—THE EXISTING AGREEMENTS RENEWED—OTHER ASSOCIATION MEETINGS.

THE fourth annual meeting of the South-West Ice Manufacturers' Association was held at the Webb City bank, Webb City, Mo., on April 10, 1894, Mr. W. O. Caldwell being in the chair. The following members were present: W. O. Caldwell, of Ft. Smith, Ark.; Mr. Redell, of Joplin; Mr. Snyder, of Carthage; Mr. Seidenstriker, of Joplin; Mr. Kimball, of Parsons; Mr. C. H. Boaz, of Pittsburg; Mr. Hager, of Webb City. Letters were read from others who could not be present.

The minutes of the last meeting were read and approved. Matters of importance were then discussed, together with the general outlook of the business. The resolutions of the past years (1891, 1892 and 1893) were read and re affirmed and signed by the members, as follows:



W. O. CALDWELL, FORT SMITH, ARK.

President of the South-West Ice Manufacturers' Association.

Resolved, That each of the concerns represented in this convention agree and covenant to abstain from selling ice in the towns other than their own occupied by plants accepting and ratifying the proceedings of this convention; and each plant shall be permitted to make and maintain prices in their home town market at their own individual discretion, and any plant which shall, without the permission of the resident manufacturer, enter the home town market of another member of this Association shall be held as violating the spirit of this agreement, and to be placed without the pale of membership and excluded from exchange of courtesies by all members of said Association.

Resolved, That it shall be incumbent upon each member, when receiving an order for ice which they cannot fill, that the order shall be forwarded by wire to the associate factory nearest the point where the order comes from (or notice of such order), which factory if unable to fill order shall pass it on by wire to the next nearest factory, and the factory receiving the message shall in each case pay telegraph charges on messages so received, and acknowledge by first mail receipt of message and what action was taken.

The date of the annual meeting was changed to the second Wednesday in March, and Parsons, Kan., was selected as the place for the next meeting.

All the members expressed their appreciation of ICE AND REFRIGERATION in giving general information concerning the ice business of the country.

W. O. Caldwell, of Ft. Smith, Ark., was elected chairman and C. H. Boaz, of Pittsburg, Kan., secretary of the Association. The meeting then adjourned.

C. H. BOAZ, *Secretary.*

OTHER ASSOCIATIONS.

——Under the name of the Cochichewick Lake Ice Co. three ice dealers have consolidated their interests. The firms entering the joint company are F. M. Greenwood, of North Andover; Caffrey & McDonnell, of Lawrence, and Edward Adams, of North Andover Center, Mass.

——The New Orleans retail ice dealers have formed an association the membership of which, April 7, was fifty-two out of about 100 dealers in the city. There is considerable interest manifested in the matter by the ice men, as there is some disatisfaction existing in their ranks as to rates on ice, the cutting proving disastrous to all parties concerned. With a membership of over fifty out of probably 100 retail dealers in the city, the chances for the organization accomplishing much good are very favorable. The following gentlemen have been chosen permanent officers of the newly organized association: Wm. Russell, president; C. A. Hope, vice-president; J. J. Foster, recording secretary, and Thos. Dwyer, treasurer.

——The ice dealers of Cincinnati held a meeting on April 19. The daily newspapers have the following report: "The ice men have been trying to maintain a schedule of prices for several months. Now they have struck a new idea. They will make an effort to divide up the profits of the business. The city, under this scheme, is to be divided into districts. As the business now stands some of the companies doing a big business encroach on the territory assigned to other companies, and there is a continual crossing and intercrossing of delivery wagons. The plan is to have the company selling to consumers in the territory naturally supplied by some other company pay a commission for the business thus gained out of the natural division of territory. The Champion Ice Co., the Corryville plant which was recently acquired by another concern, the Cincinnati Cold Storage Co., the Arctic ice plant and others are interested."

——The Wholesale and Retail Independent Ice Dealers of Hudson County, N. J., met at Hoboken, April 17, and fixed the scale of prices to consumers for the coming season. The attendance was large. G. L. Heath of the New Jersey Ice Co., presided. The rates agreed on were: Families, 50c. per cwt.; grocers, etc., 30c. The question being asked what redress dealers would have in cases where other dealers secured the customers from them, Mr. Heath said there was but one way to make the agreement a success and that was for each man to stand firmly and honestly by the scale. A very through discussion of all the conditions of the trade was had and several abuses were ventilated in a way which, it is believed, will benefit the trade. It was agreed that the dealers interested in the combination should purchase all their ice on the New Jersey side of the river. Messrs. Bahrenburg, Ross, George Letts, Kruger and Schroeder were appointed a committee to investigate all complaints of violations of rules. The following wholesale price was submitted by Chairman Heath: Independent dealers, $3 per ton; licensed venders, $4; butchers, $4; vaults, $5.50; fine ice, 10c. per basket.

BREWERY REFRIGERATION NOTES.

——The new 50-ton machine in the brewery of the Germania Brewing Co., Baltimore, was started up March 29.

——The Germania Brewing Co. has erected a 27-ton Frick Co. refrigerating machine in their brewery at Baltimore.

——The Frick Co. has completed piping, etc., for direct expansion work for the John Hauck Brewing Co., Cincinnati, Ohio.

——The Vilter Manufacturing Co., of Milwaukee, is at present installing a 100-ton refrigerating machine for the Phœnix Brewing Co., of Pittsburgh, Pa.

——The Frick Co., Waynesboro, Pa., have finished the erection of a 150-ton refrigerating machine with ammonia tank system for Hudepohl & Kotte's Buckeye brewery at Cincinnati, Ohio.

——The Arctic Machine Manufacturing Co., of Cleveland, Ohio, have just closed a contract with the National Brewery Co., of St. Louis, Mo., for one of their improved 70-ton refrigerating machines.

——The Arctic Machine Manufacturing Co., of Cleveland, Ohio, have closed a contract to place in the brewery of Columbia Brewing Co., St. Louis, Mo., one of their latest improved 110-ton refrigerating machines. It will be placed in position immediately, and in operation in the course of a few weeks.

[*Written and Illustrated from Photographs Specially Made for* ICE AND REFRIGERATION.]

A PLATE SYSTEM ICE PLANT.

DESCRIPTION AND ILLUSTRATION OF THE PREMISES OF THE EAST ST. LOUIS ICE AND COLD STORAGE CO.—ICE MAKING BY FRICK CO.'S PATENT PLATE SYSTEM—HOW PLATE ICE IS HARVESTED AND HANDLED BY SPECIAL MACHINERY—ART PRODUCTIONS FOR TABLE DECORATIONS CARVED FROM PLATE ICE—DETAILS BY ILLUSTRATION OF THE MACHINERY OF THE PREMISES.

GEO. W. DECKER, PRES.

THE East St. Louis (Illinois) Ice and Cold Storage Co. was incorporated in July, 1891, by Geo. W. Decker, Otto F. Stifel, C. H. Sharman, W. S. Hodges and S. C. Church, with a capital of $300,000. Geo. W. Decker was the first president of the company, and has since succeeded himself. The present officers are: Geo. W. Decker, president; Otto F. Stifel, vice-president; E. C. Newkirk, secretary; A. C. Church, treasurer, and W. H. Miller, Jr., general manager.

The company, while completing its organization and awaiting the charter, appointed a committee to visit and fully investigate the various systems employed in the manufacture of ice in the cities of St. Louis, Cincinnati, Owensboro, Chicago, Pittsburgh and other points, who upon their return made a unanimous report in favor of the plate system of manufacturing ice; and pursuant thereto, upon August 10, 1891, they contracted with the Frick Company, engineers, Waynesboro, Pa., for a complete ice making plant of their patent plate system to produce 125 tons of ice daily and in addition to refrigerate 300,000 cubic feet of cold storage, said plant to contain all the refinements and improvements in the line of ice manufacturing and steam engineering, the amount of the contract being the largest in the history of the ice making and refrigerating business. The conditions of the agreement were that the machinery and factory should be arranged for an ultimate extension up to a capacity of the company's property, equaling about 800 tons. The company were fortunate in being able to secure a plot of ground 300×1,200 feet in East St. Louis in the midst of the system of railways centering in East and St. Louis proper, communication with each of the roads being effected by means of their own private switches, which placed them in virtual control of the ice and cold storage distribution and business of the two cities, and particularly of the "icing" and "re-icing" of refrigerator cars, of which the company make a specialty.

As the stipulations of the contract were such that the

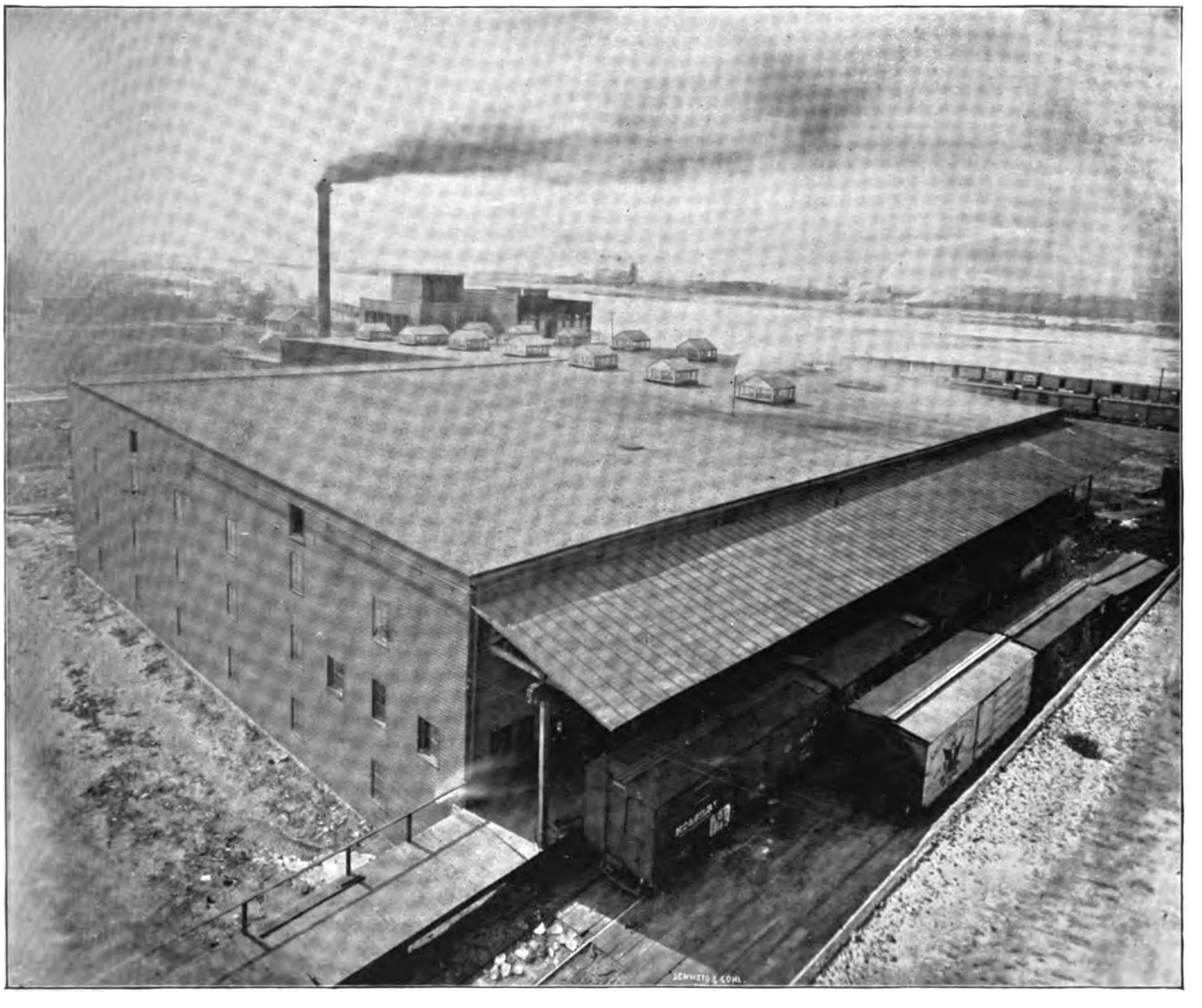


FIG. 17.—EAST ST. LOUIS ICE AND COLD STORAGE CO.—VIEW OF PREMISES LOOKING SOUTHWEST TOWARD THE MISSISSIPPI RIVER.

plant should represent the best and most modern practice in steam engineering, Frick Company introduced for the first time in the manufacture of ice their improved tandem compound condensing ice machines, steam power traveling cranes for harvesting and handling the large blocks of ice, compound condensing power engines for driving power cranes and transfer, and circulating pumps and electric light plant. The brine circulation, boiler feed, main water supply and deep well pumps are compound condensing, and the steam boiler plant is specially adapted for high pressure and arranged to burn in the furnaces the cheap grade of fuel found so plentifully in the southwest. The handling of ice and cutting the large cakes into blocks about twenty-two inches square and to reduce the operating expenses of the entire factory to a minimum received special attention. The results obtained justify the expenditure of skill, time and money, as the plant produces 130 tons of ice daily with, it is believed, fewer tons of fuel and a smaller crew of operators than is possible in any other system. We will further on more fully explain the various details of construction at length, taking them up in their order.

In order to give the reader an idea of the magnitude and comprehensive character of the works, we refer them to the outline plan, Fig. 1, showing factory as at present in use, the dotted lines showing the probable future extensions. The entire plant in all its details was designed by Frick Company, who furnished all of the machinery, also the plans for the ice factory buildings, cooperating with the firm of Link & Cameron (now Theo. Link), architects, of St. Louis, who were employed as superintendents of building construction. When the plant was nearly ready for operation, an unprecedented rise of the Mississippi river seriously delayed the starting

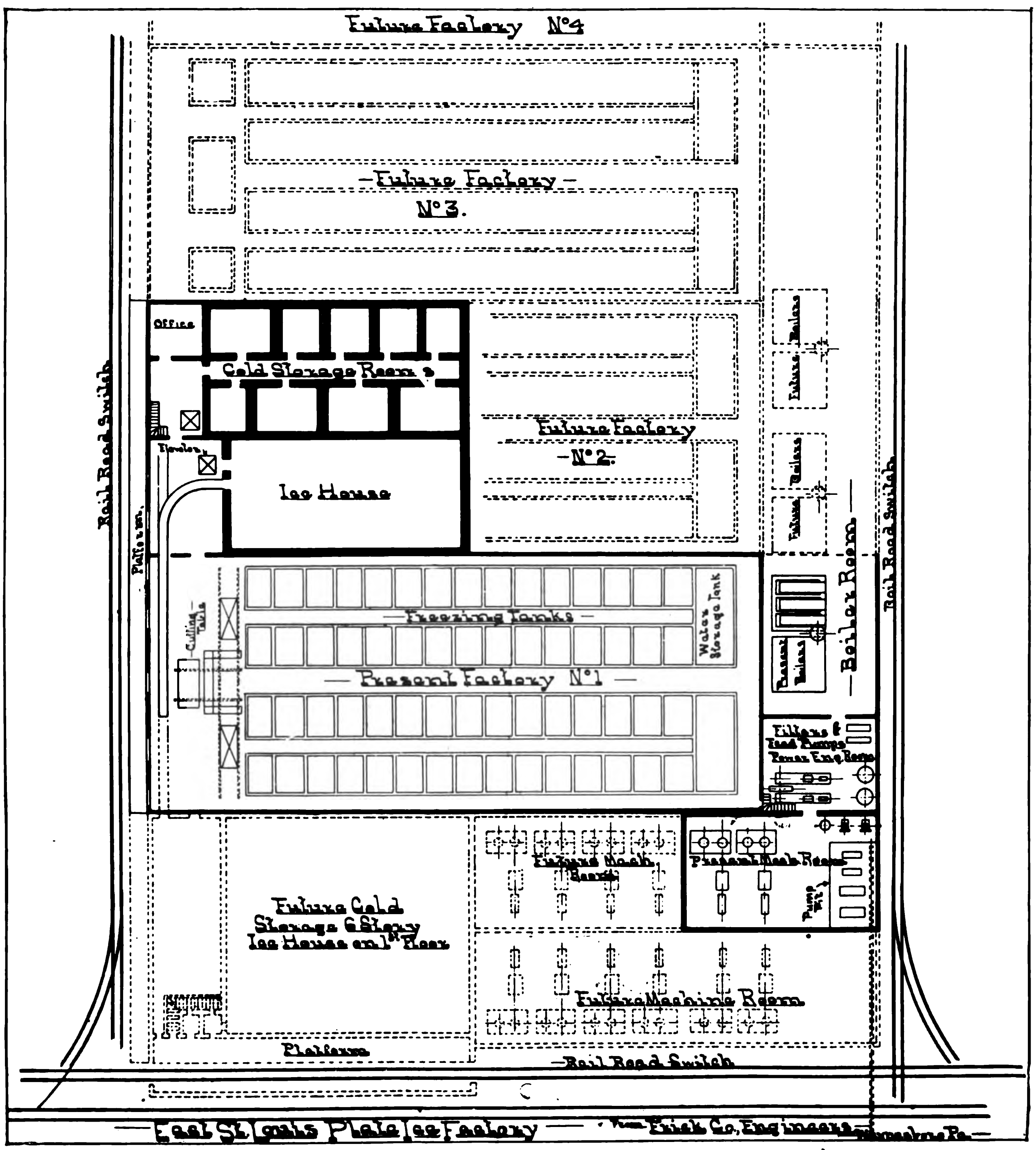


FIG. I.—THE EAST ST. LOUIS ICE AND COLD STORAGE CO.—GROUND PLAN OF FACTORY, WITH PROPOSED EXTENSIONS.

of the plant, the entire machinery being submerged for several weeks, causing a heavy loss, as well as making necessary a large additional and unexpected outlay to provide against any possible recurrence of the same trouble, which expense has, however, proved very beneficial to the plant, which has been an eminently successful one from the start.

The buildings consist of machine house, 72 × 50 feet in area, fifty feet high at the southwest corner of the grounds, the lower story (thirty-five feet high) of which contains the ice machine room, in which are also located the air pumps, boiler, feed water heater, and water supply pumping station. In the second story is located the ammonia condensing room. Adjoining this on the east is a building 50×38 feet, sixty-four feet high, in the lower story of which is the power engine house as well as the filtering room, and which contains also the boiler feed pumps. The second story is occupied by the dynamo room and the spacious office of Mr. Scholl, the general superintendent. The third story is occupied by the repair shop and stock room. Joining this on the east again is the boiler room, 66×50, twenty-four feet high. To the north of the power engine room and boiler room is the freezing tank room, which is two stories, 259×104 ft. in size, thirty feet high. To the east of tank room is the ice storage house, 130 × 50 feet in size, thirty feet high, in the front end of which is located the room containing the machinery for reicing refrigerator cars, and also the ice elevator of the type made by the Link Belt Machinery Co., Chicago. To the east of the ice storage house is the cold storage department, 130 ×54 feet in size, forty-seven feet high, divided into three stories. The northeast corner of the second floor is occupied by the general offices of the company. All the buildings are of brick and iron except the tank room and cold storage rooms.

The first illustration of the ice machine engine room (Fig. No. 3), shows the two Frick compound condensing ice and refrigerating machines, the compressors of which are 17 × 36 inches and 20×36 inches respectively, the combined capacity being 160 tons of ice daily.

E. C. NEWKIRK, SEC'Y.

FRANK SCHOLL, GEN'L SUPT.

W. H. MILLER, JR., GEN'L MNGR.

OTTO F. STIFEL, VICE-PREST.

The second illustration of this room (Fig. No. 4) shows the water supply pumping station, which is located in a pit, consisting of four Knowles pumps of the duplex outside packed plunger pattern, two of which are compound condensing and two the regular pattern. These pumps furnish the entire water supply of the plant, which is drawn through a 24-inch main directly from the Mississippi river, delivering the water into a reservoir located on the roof of the power engine room building, from whence it is distributed to the various points of consumption. These pumps are also connected with a system of pipes which distribute water throughout the entire plant for use in case of fire, which, with a liberal supply of hose at different points of the plant, give a most complete protection against that element. To the east of the pumping station pit, which occupies two-thirds of the width of room, are located, on the main floor, two Conover air pumps and exhaust steam jet condensers, made by the Conover

FIG. 19.—TABLE AT BANQUET OF ST. LOUIS CLUB, SHOWING ORNAMENTAL CENTER PIECE.

Manufacturing Co., 95 Liberty street, New York, and a Goubert compound engine feed water heater, made by Goubert Manufacturing Co., New York, and furnished by J. H. Siegrist, Jr., & Co., St. Louis.

A striking feature of the engine room is the fine gauge board, combined engineer's desk and locker, which was designed by Frick Company (see Fig. 9), who supplied the outfit of Shafer & Budenberg ammonia, Ashcroft clock and steam, vacuum, water and brine, and Edson recording gauges. The three Edson pressure-recording gauges, made by Jarvis B. Edson, Liberty street, New York, automatically record the "high" and "low" ammonia pressure carried. They also, by their electrical alarm devices, ring an electric bell when the "high" ammonia pressure exceeds the economical limit, or when the "low" ammonia pressure falls below the safety limit, endangering the admission of air. Applied in this way, these recorders are considered indispensable to an ice making or refrigerating plant. The locker contains a complete set of Crosby indicators, with all instruments required for making tests, etc.

Directly over the ice machine engine room is located the ammonia condensing room, the condensers consisting of ten stacks of coils arranged in five coils to each stack, as shown in Fig. 5, by which it will be seen the condensers are of the surface, or atmospheric, type, the general arrangement being an efficient one and presenting a pleasing appearance. This room also contains the two high pressure traps, through which the gas passes from the machines before entering condensers, and the two liquid receivers into which the liquefied ammonia passes before going to the expansion coils. We make note here in passing that the machine room is a semi-fireproof structure, the condenser floor being made up of steel beams, with concrete arches of large span, which construction has proved perfectly satisfactory.

The power engine room (Fig. No. 6) contains one 100 horse power Frick Company's compound condensing Corliss engine, which furnishes the power for the entire plant; also two Hyatt filters, made by Hyatt Pure Water Co., of Newark, N. J., which filter all the water used for ice making and boiler purposes; also two Knowles duplex plungers, compound condensing boiler feed pumps, a Goubert feed water heater, and the switch boards for the electric lighting and for the signal and fire alarm service. The dynamo room above contains one 400-light incandescent dynamo, built by the United States Electric Lighting Co., of Newark, N. J., which furnishes the light for the entire plant. The second story of the power engine house (Fig. 7) shows the main jack-shaft and 400 light dynamo room. Above the third story, supported on independent iron columns rising from the foundations below, is the water supply tank previously mentioned, with capacity of 30,000 gallons and weight of 250,000 pounds. The boiler room (Fig. 8) adjoining contains six Frick return tubular boilers of 100-horse power each, in two batteries of three boilers, each boiler 66 inches diameter, 20 feet long, containing eighteen 6-inch flues.

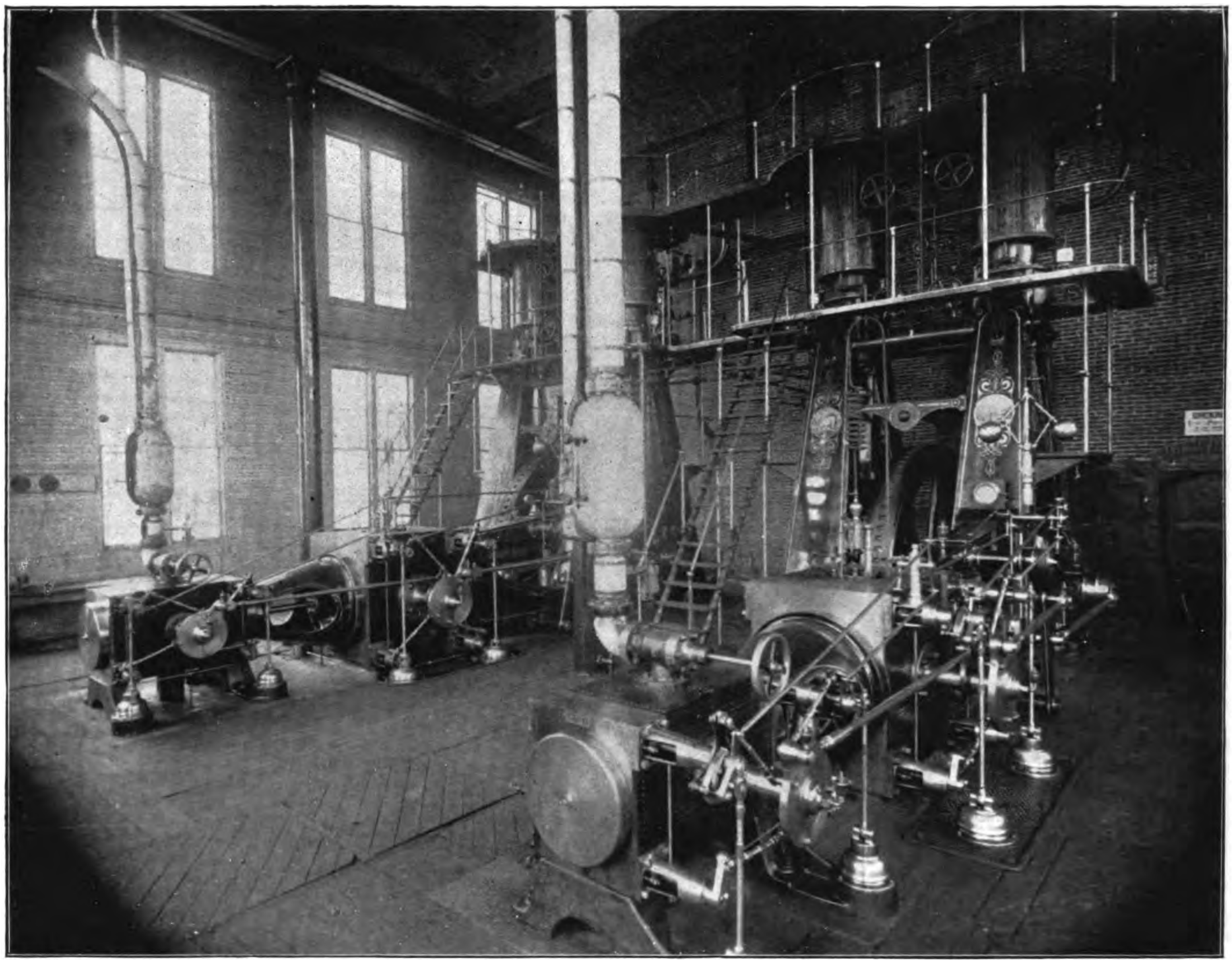


FIG. 3.—EAST ST. LOUIS ICE AND COLD STORAGE CO.—ICE MACHINE ROOM.

These boilers are fitted with all the modern appliances for generating steam economically, all feed water being first filtered in the patent pure water filter. Mud drums and bottom blow-offs are provided and the whole arrangement of boiler plant and appurtenances is considered a model one, being equipped with Hoppes live steam purifiers, made by Hoppes Manufacturing Co., Springfield, Ohio, Reliance safety water columns, made by the Reliance Gauge Co., Cleveland, Ohio. In connection with the steam service there is used a device which removes one of the unpleasant and often dangerous features of a steam plant: that of the "pounding" of condensed water in steam pipes. This device is called the "Loop," and cranes, and borne quickly and noiselessly to the cutting table, and there sawed into blocks of about 200 pounds each, and then conveyed into the ice house by a system of power conveyors. This end of the factory presents a busy scene, and one in which all visitors seem most deeply interested. Referring to these illustrations which, together with all the other illustrations herewith, were made from photographs taken for the special benefit of the readers of ICE AND REFRIGERATION, Fig. 10 shows one of the cakes of ice taken at random, size sixteen feet long, thirteen inches thick, weight about 8,000 pounds. Standing behind the ice is Manager Miller, Superintendent Scholl and the engineers of the ice factory. Fig. 11

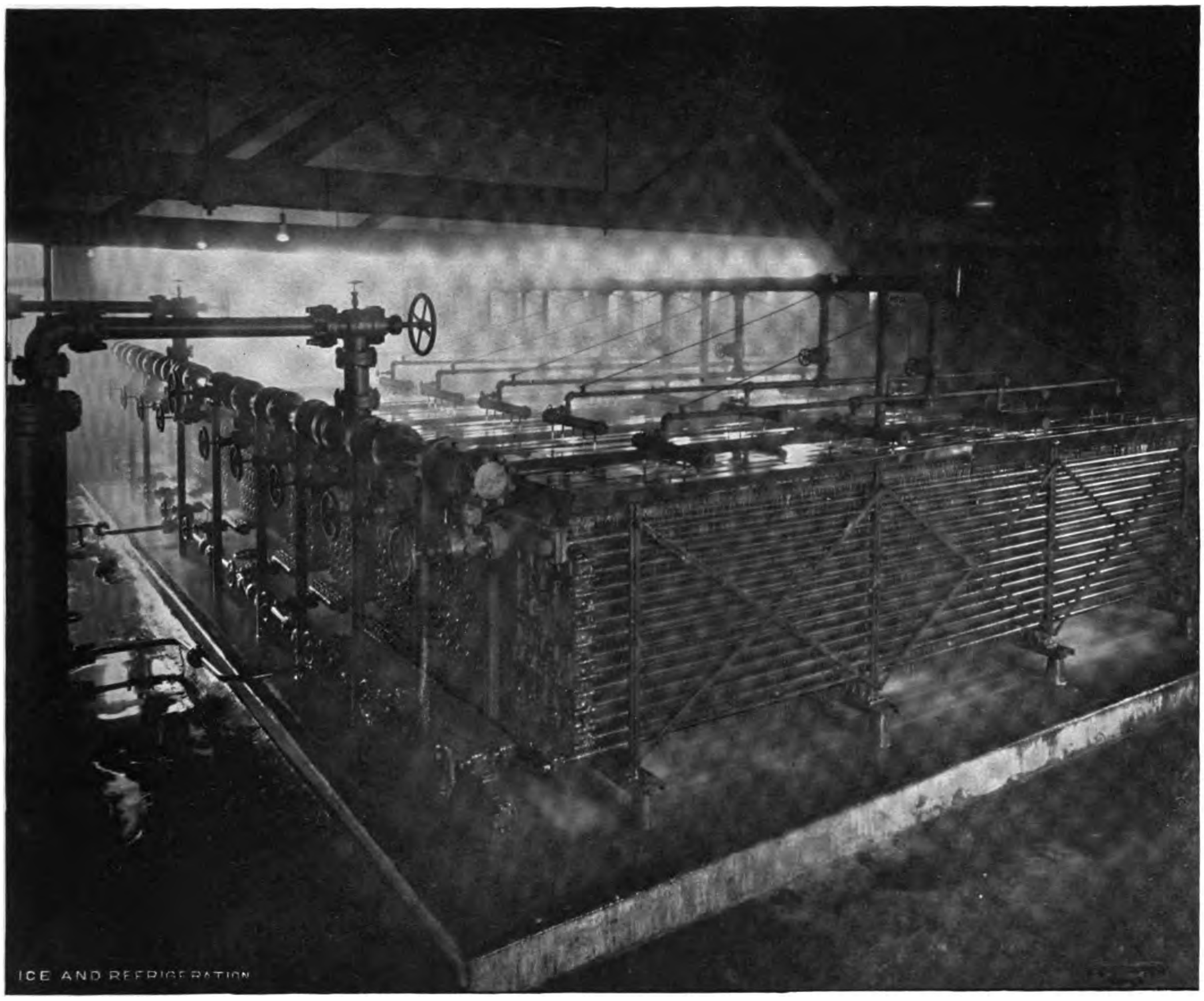


FIG. 5.—EAST ST. LOUIS ICE AND COLD STORAGE CO.—AMMONIA CONDENSER ROOM.

carries all the condensation from the pipes back to the boilers by gravitation. It is a most successful appliance, and can be heartily recommended to the trade. It is made by Westinghouse, Church, Kerr & Co. The boiler domes and all steam pipes are covered with magnesia sectional coverings, made by Keasbey & Mattison Co., Ambler, Pa.

The freezing or tank room (Figs. 12 and 13) is to the engineer, the novice, the ice consumer, and to all of high or low degree whose good fortune permits them to enter its walls (the ice company cordially invite all), one of the most fascinating and interesting departments of the extensive plant; for it is here the ice is made in large plates; is lifted from its birth-place by powerful steam shows another cake, with the entire force of the ice factory, from the general manager down, and, by counting noses, the reader can see how many men it takes to run a 130-ton plate plant, with cold storage attached, with all its allied departments, such as loading into cars, icing refrigerator cars, packing into ice house, etc. Fig. 12 shows to the right a cake of ice suspended from the traveling crane ready to be lowered upon the swivel table, which, by the way, is already occupied by a cake in the act of being pushed through under the "first cut" saws, which mark the cake by sawing half way through. When the cake is pushed through the "second cut" saw-table placed at right angles to the first, the cake being landed to the left, as shown in the illustration, the

"splitter" standing on the cake wielding a splitting fork, with which he easily and deftly separates the cake as marked by the saws into blocks of 22×22 inches, which slide into the ice conveyor, as shown, and are carried into the ice house. Fig. 13 is a photo from a different point of view, and shows more clearly the arrangement of the sawing tables and appearance of the cake after passing through them.

The operator, standing on the platform, controls by means of five levers the following functions: First, the swivel table, which is a pivoted section of the floor operated by power and is swung into position at an angle of about 20° from a vertical to receive the ice cake, which is carefully lowered until its edge rests upon the shelf fitted to one side of the table to prevent its sliding off. When the weight has been taken by the table the crane slings are cast adrift, the table swinging back to normal position. The operator pulls the second lever, which operates the pusher, and there is a hiss and whiz and the cake is fed through the saws; and in less time than it takes to tell it, it is on the landing ready for harvesting. Other levers start and stop the saws. The hoist crane travel is about 250 feet and is operated by a boy.

From the illustration of tank room it is not possible to get a perfect idea of the arrangement of the plate system, as all the freezing apparatus is hidden in the tanks under the main floor, and is so constructed as to make it impracticable to photograph it satisfactorily. The room is divided into two divisions by a line of pillars running north and south to within forty feet of north end of the room, which part is trussed over for the ice cutting and conveying machinery. Each of these divisions is divided into two sections of tanks, each containing fifteen compartments, or tanks, to the section, giving a total of sixty compartments, while each compartment contains four cells, 9×17 feet each, or 240 cells. Each cell is composed of two steel plates, 8×16 feet, containing ammonia evaporating coils, which are surrounded by brine. The cells are placed in the compartments at such distances apart as will allow the formation of ice to proceed without freezing together, the ice building process going on until the cakes stand within a few inches of each other. At the south end of tank room are the two large fore-cooling tanks, into which the water for the ice making passes, after the purifying processes, and before freezing. After leaving the last filters, the water passes through a conduit in which are placed the return gas pipes from the evaporating coils, which partly cool the water before it enters the fore-cooling tanks, where it is further cooled by direct expansion coils to as near freezing point as possible before going to the freezing compartments. From this tank the water is distributed by two centrifugal pumps built by Morris

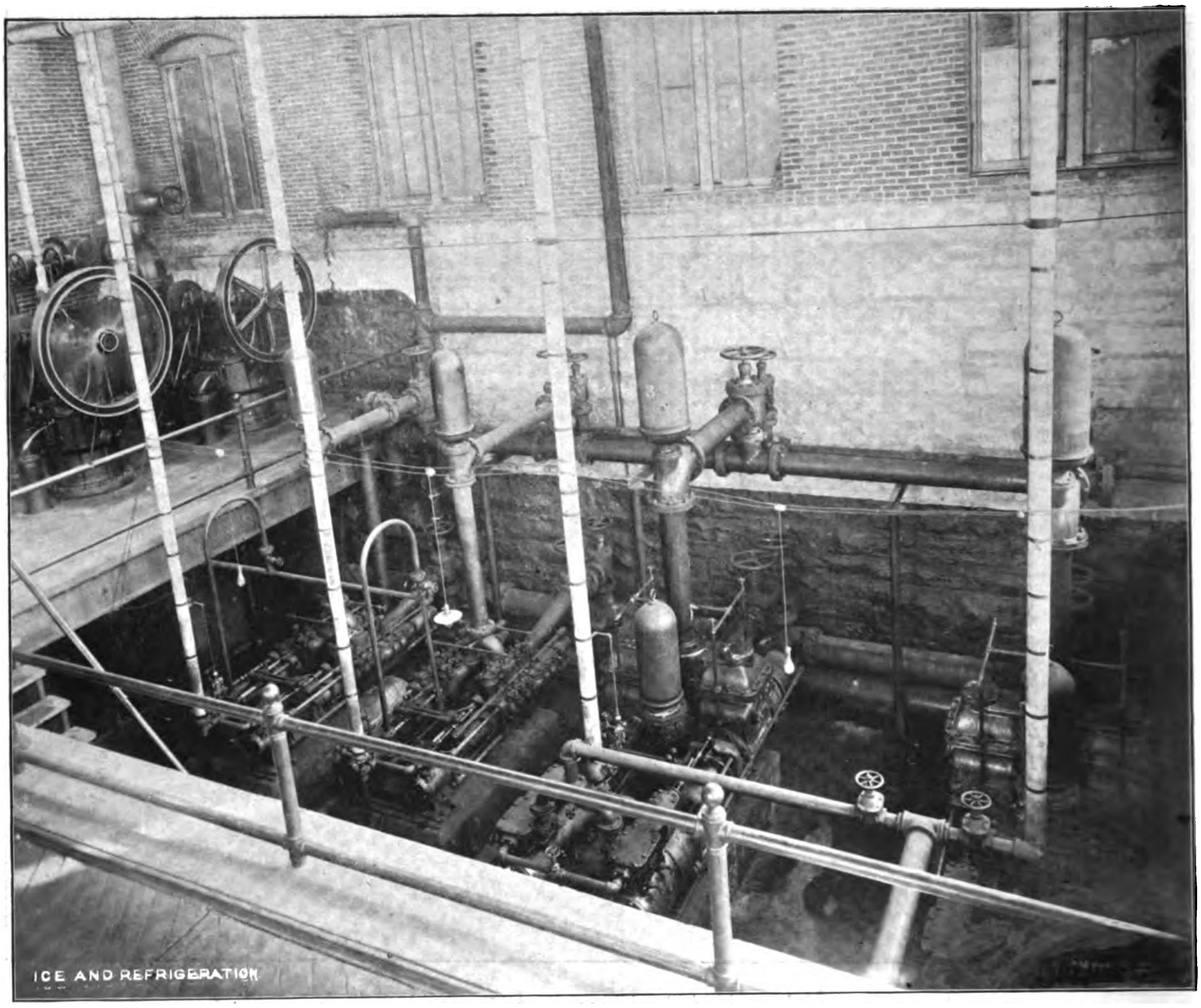


FIG. 4.—EAST ST. LOUIS ICE AND COLD STORAGE CO.—WATER SUPPLY PUMPING STATION.

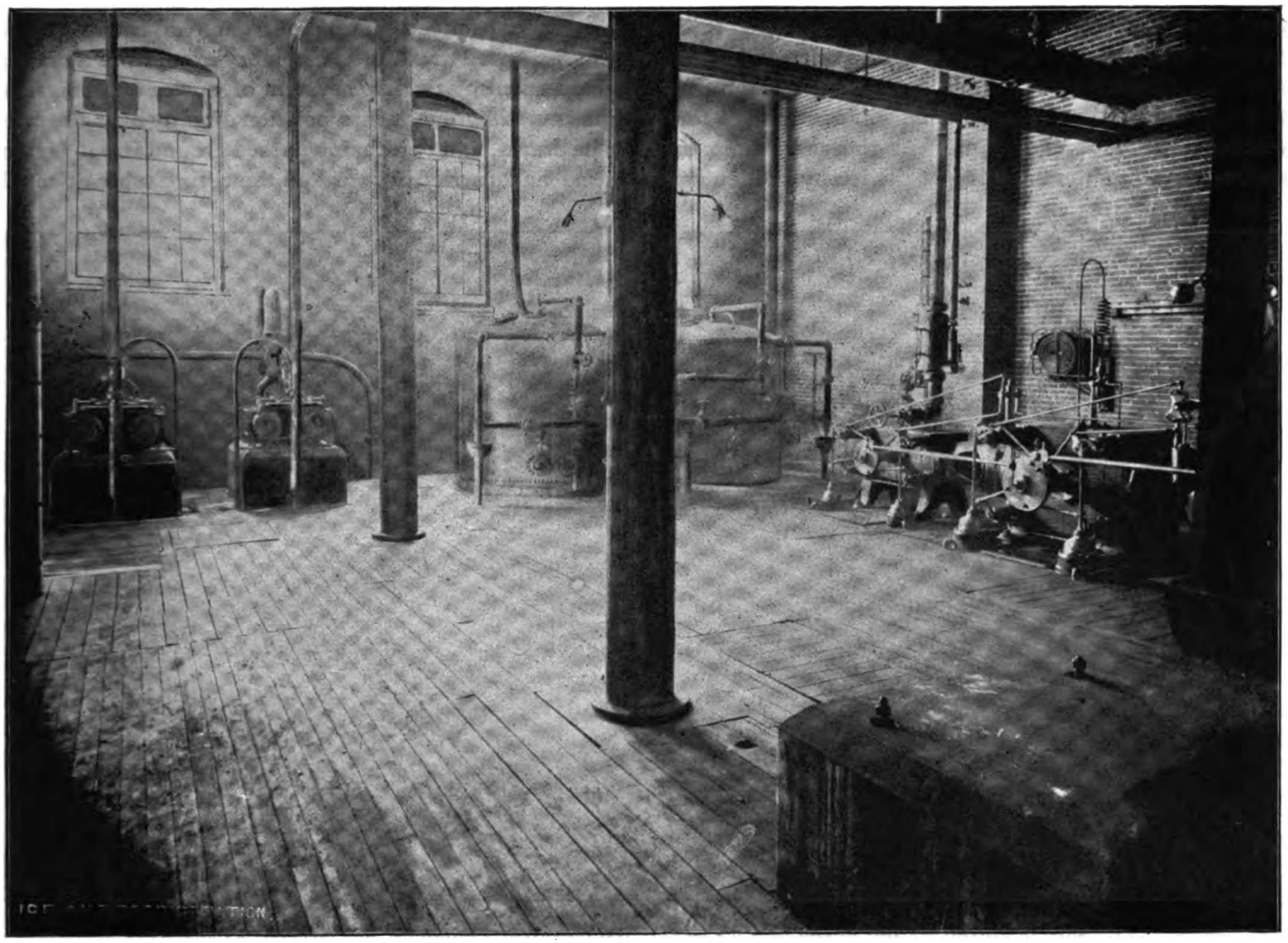


FIG. 6.—EAST ST. LOUIS ICE AND COLD STORAGE CO.—POWER ENGINE, FILTER AND FEED PUMP ROOM.

Machine Works, Baldwinsville, N. Y., to the freezing compartments—a style of pump specially suited to this class of work because of its compactness and economy of space and in the use of steam, and the pump is in extensive use in ice factories. After these compartments are filled, the expansion is started and freezing is continued

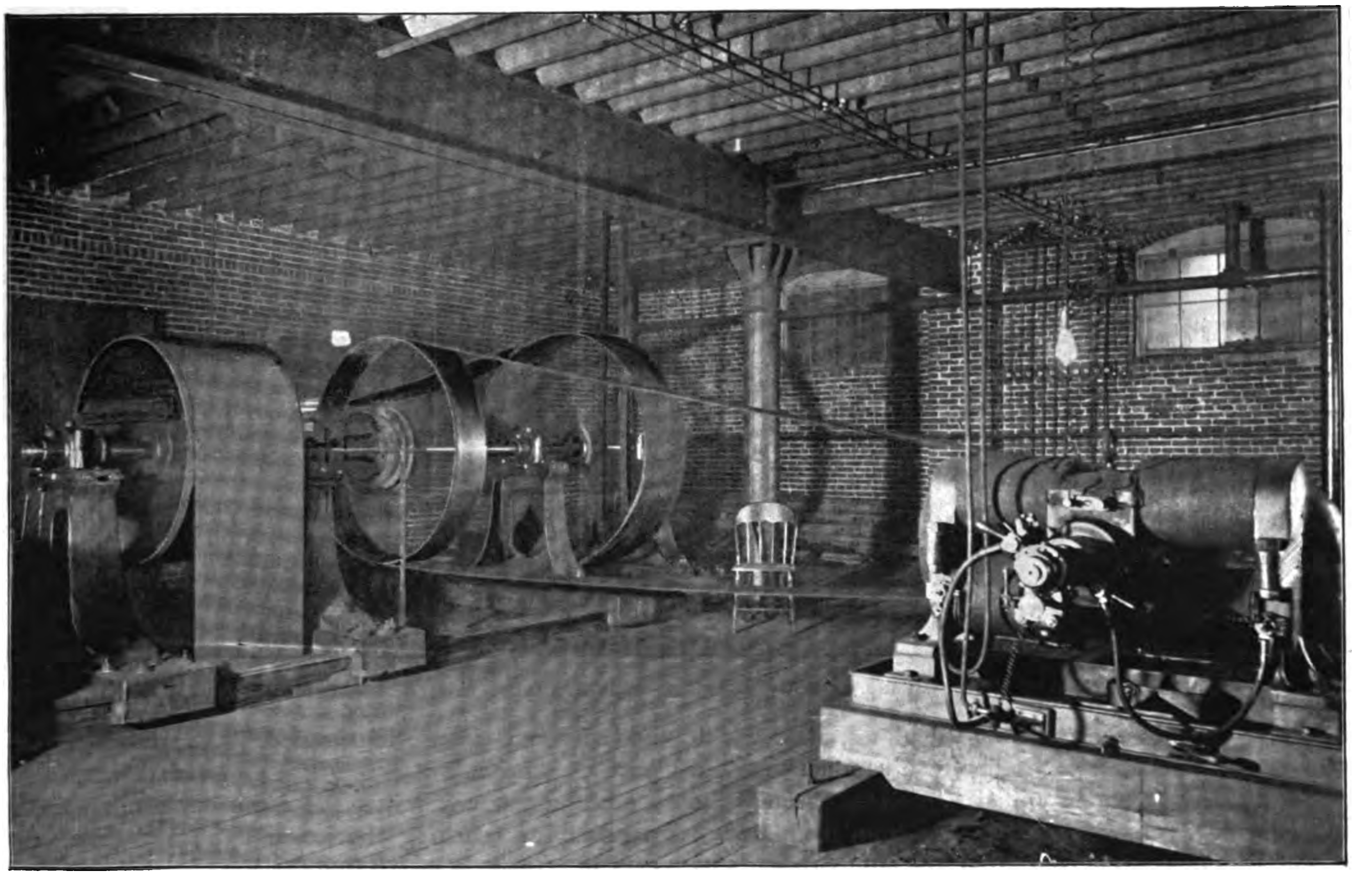


FIG. 7.—EAST ST. LOUIS ICE AND COLD STORAGE CO.—MAIN JACK-SHAFT AND DYNAMO ROOM.

until the ice is formed on the plates to the desired thickness (which is from twelve and a half to thirteen inches), when the expansion is shut off and the ice left for a few hours, as for this length of time ice will continue to form without the aid of expansion. At the same time this method prevents the breaking of the ice by sudden contraction when it is thawed from the plates, after which brine, warmed to from 50° to 60° in a storage tank, in which is placed a steam coil, is circulated through the cells by gravity, thus thawing the ice from the plates.

The ice is then removed from the compartments by the means of two Frick traveling cranes of 10,000 pounds carrying capacity each, one for each division. These cranes, as well as all the machinery except the dynamo, are operated by the rope system of power transmission. The crane is brought into position directly over the cake to be drawn, and two chains passed around it. It is then raised and carried forward to the tilting table at north end of room, as previously described. Adjoining that part of the tank room (Fig. 14) which contains the ice cutting machinery is the room containing the apparatus for crushing the ice and re-icing refrigerator cars in transit, in which line the East St. Louis Ice and Cold Storage Co. do an immense amount of business,

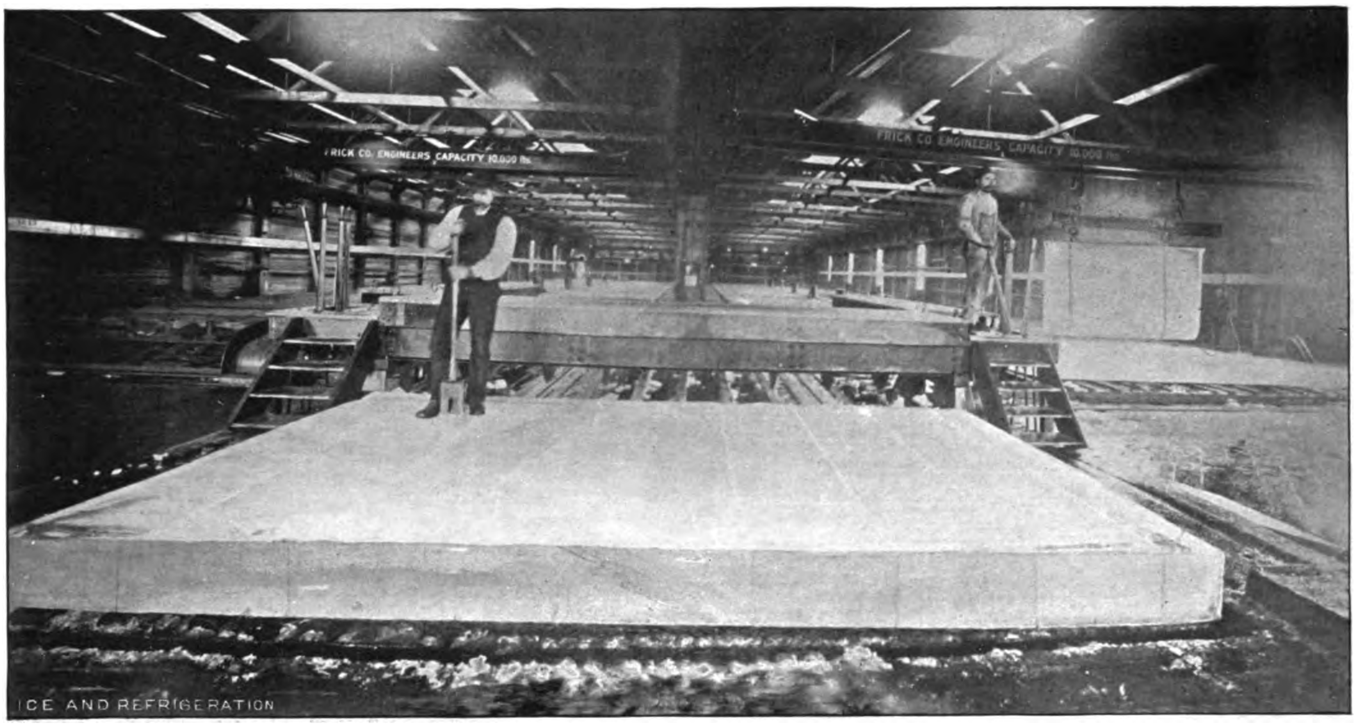


FIG. 13.—CAKE OF ICE READY FOR SPLITTING, HAVING PASSED THROUGH ICE CUTTING SAWS.

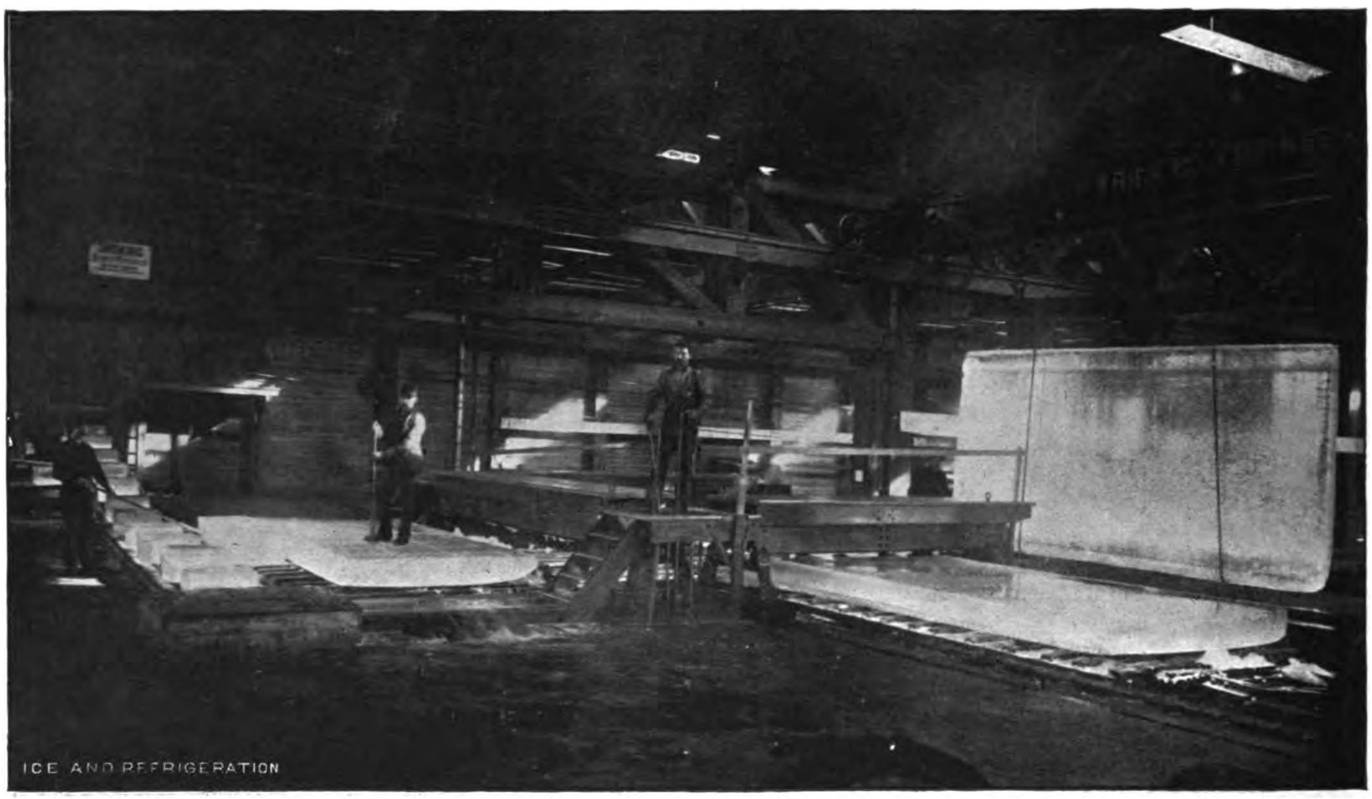


FIG. 12.—HARVESTING ICE BY MEANS OF POWER CRANES—SWIVEL TABLE, SAWING, SPLITTING AND CONVEYING.

situated as they are right among the many railroad tracks converging east and west at this point. Their facilities are so complete that a car can be re-iced in an unusually short time. In this room is also the ice ele-

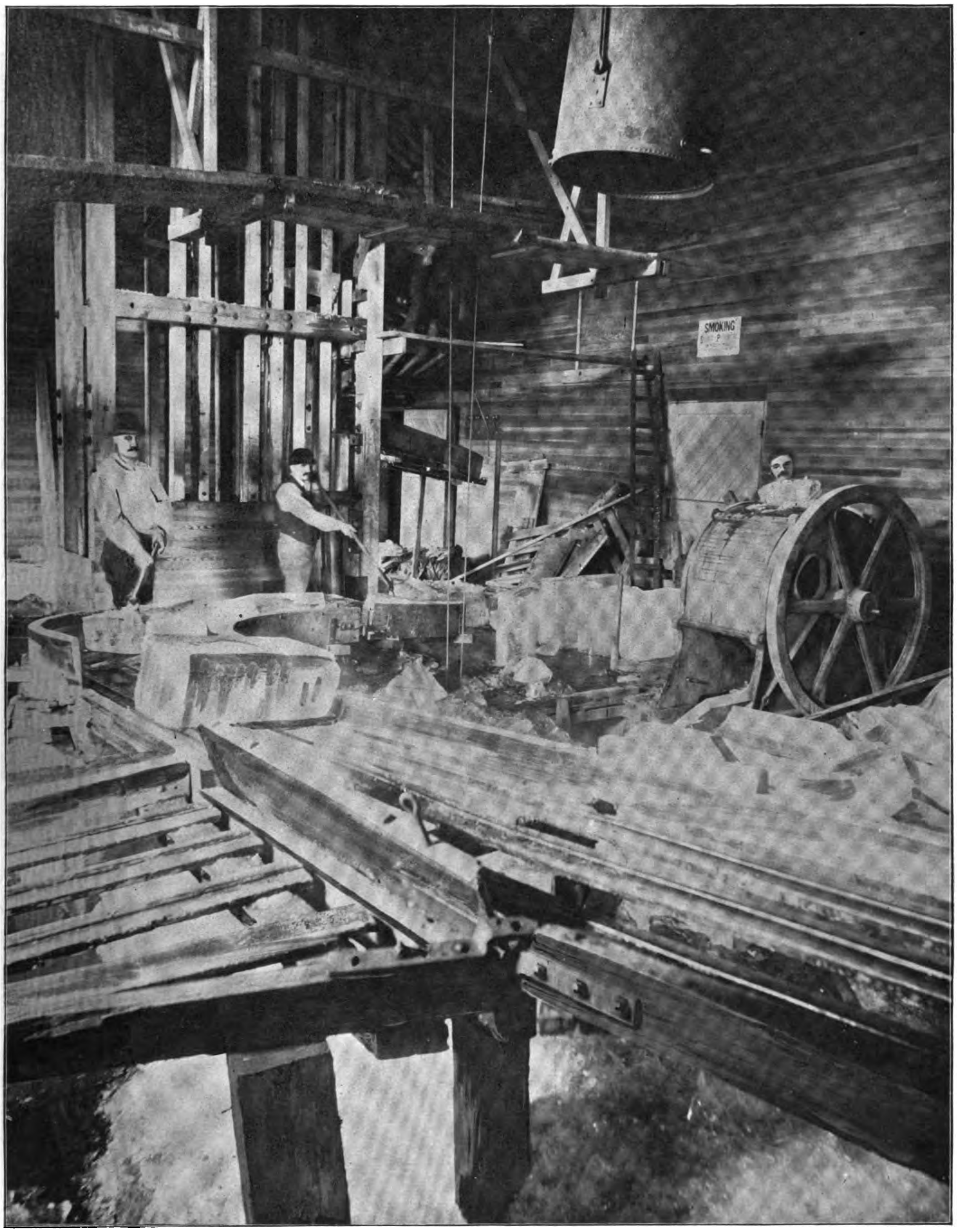


FIG. 14.—ICE CONVEYORS TO ICE HOUSE AND ICE BREAKER FOR ICING REFRIGERATOR CARS.

vator for transferring the ice from the conveyor to the ice storage houses. This machinery also was built by the Link Belt Machinery Co. To the south of this room are the ice storage rooms, which have a capacity of 3,000 tons.

The drawing (Fig. 1) shows the final arrangement of the factory when completed, and it will be noticed that the cold storage department is then to be built adjoining Factory No. 1, and against the future extension of the engine room, or southeast corner. The size of the

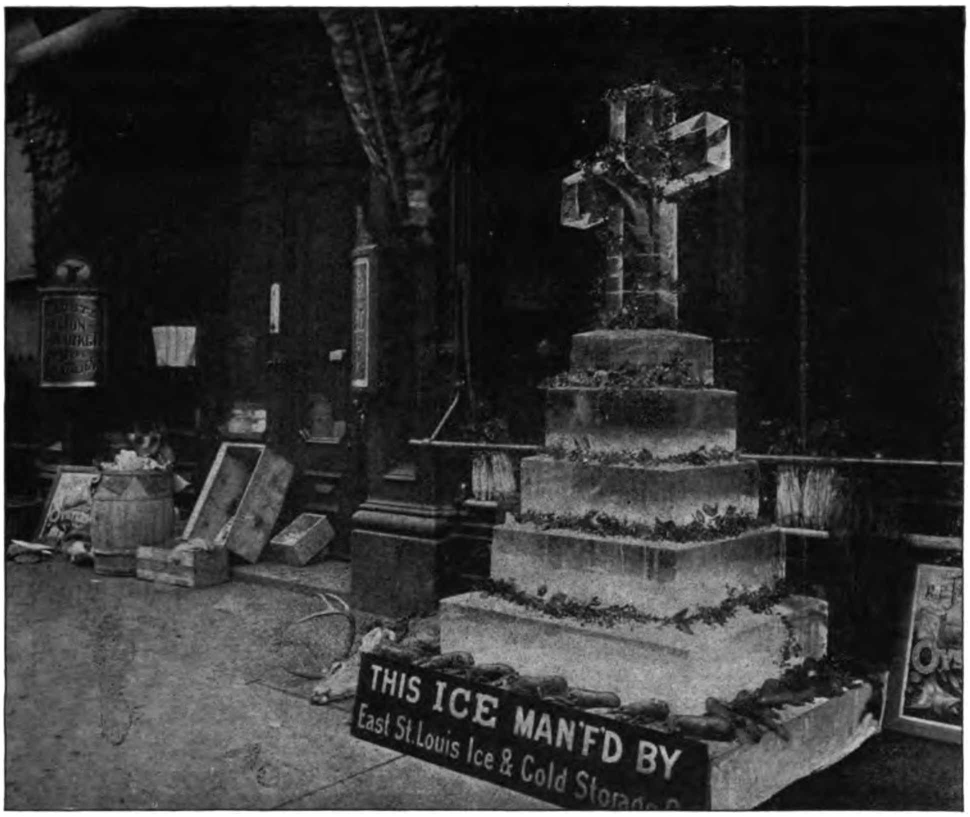


FIG. 18.—ORNAMENTAL EXHIBIT OF PLATE ICE—TONY FAUST'S MARKET.

storage department is to be 150 feet long by 125 feet wide and seven stories high, fitted with several elevators; main office on the second floor, the ice storage house, thirty feet high, ice reserve and ice shipping room occupying the lower floor. The arrangement of railroad switches, or track system, as one might say, surrounding the works, is clearly shown in this drawing, Fig. 1. Coal can be dumped from cars into boiler room, whole trains of refrigerator cars can be iced, cold storage received and loaded for shipment, all at the same time and on different tracks, making one of the most complete and unique systems to be found anywhere, and particularly adapted for the business under discussion. As future extensions will be made to the north, and owing to the limited time and desire to get the business started, it was proposed and carried out as a temporary measure to build one-half of Factory No. 2, size 104×130 feet, thirty feet high, and utilize it for the present by arranging a space 50 × 110 by thirty feet for ice storage, and divide the remaining space, 50 × 130, into three stories, conveniently divided into cold storage rooms, the general arrangement being shown in Fig. 1. A portion of the second floor is reserved for office use. Fig. 14 shows one of the main hallways or passages, leading from which are the various cold storage rooms, right and left. Fig. 15 is the interior of a freezing, or chill, room with its contents. The pipes through which the cold brine is circulated, and thereby refrigerating the room to any desired temperature at the will of the operator, are seen against the sides of the room. All classes of cold storage are kept in this department, the writer having seen such odd things as young trees direct from the nursery, seeds which it was desired to prevent germinating, fur cloaks and woolen goods to keep out moths, etc.

The present house, as above described, containing 300,000 cubic feet of space, is constructed of wooden materials throughout, and is insulated with "P. & B." paper, made by the Standard Paint Co., New York and Chicago, with mineral wool and matched board. It contains no special structural features that need particular mention further than to say that the three floors have each an ante-room through which passes the elevator, built by B. W. Moon, St. Louis, Mo. These rooms have a door leading into the main hallway, which extends the entire length of this building, the storage rooms opening upon this hallway. The entire storage house is refrigerated by Frick Company's system of brine circulation, the circulating coils being placed on the walls, as shown

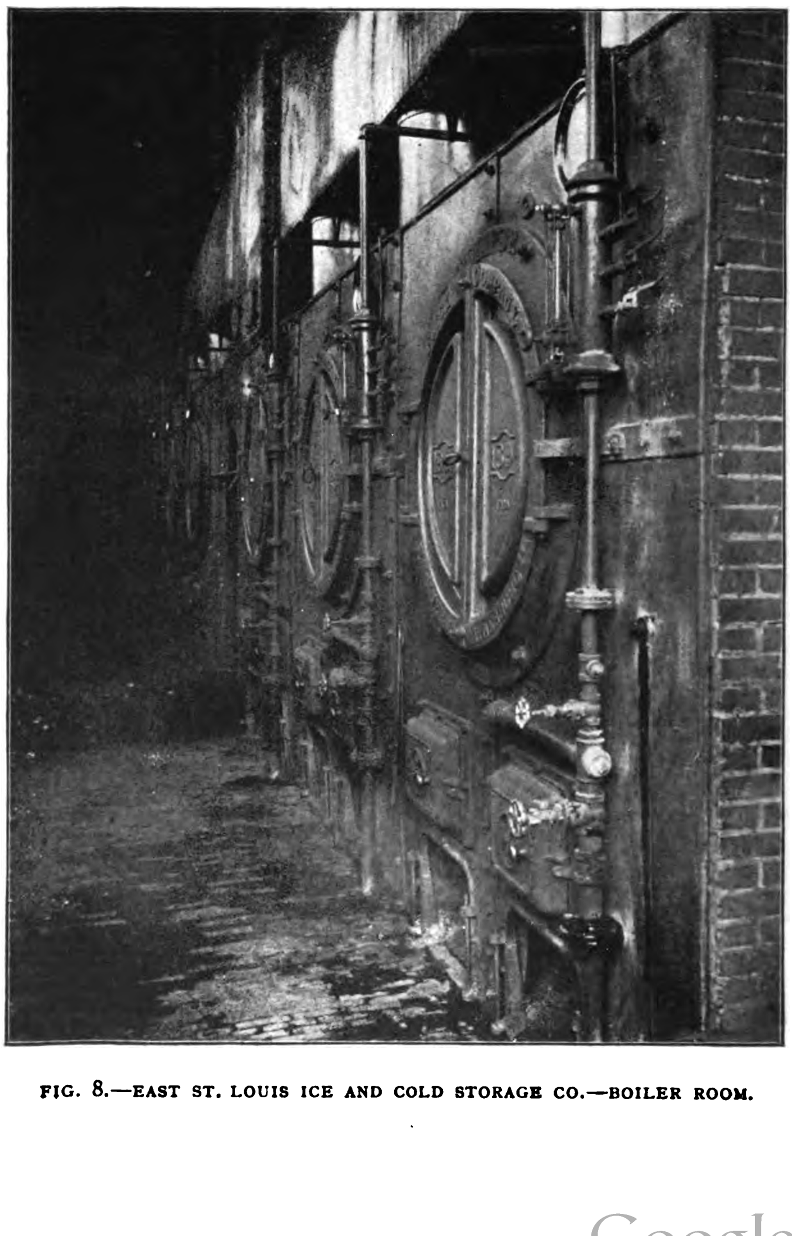


FIG. 8.—EAST ST. LOUIS ICE AND COLD STORAGE CO.—BOILER ROOM.

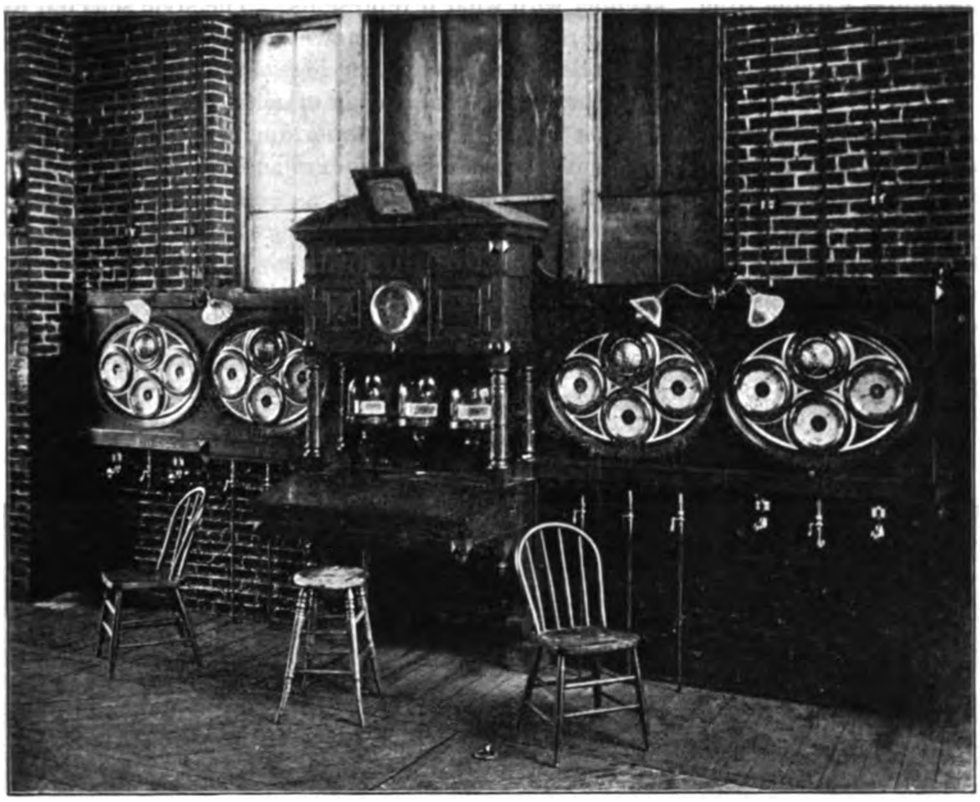
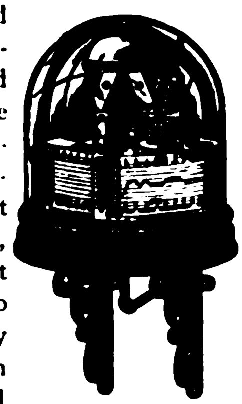


FIG. 9.—GAUGE BOARD, INSTRUMENT LOCKER AND ENGINEER'S DESK.

in the illustrations. The brine is circulated by means of one Knowles duplex compound pump, and one Deane duplex pump, built by Deane Steam Pump Co., Holyoke, Mass. These pumps are situated at the side of the brine tank, which is located in the lower story of the tank room, directly under the ice cutting machinery. All the brine pipes between the pumps and cold storage rooms, both feed and return, are thoroughly covered with a special brine pipe covering furnished by F. Boeler, 108 Walnut street, St. Louis, Mo. The plant contains over 3,000 valves of every sort, all of which were manufactured by Lunkenheimer Co., Cincinnati; Jenkins Bros., New York, Chicago, etc., and others. The building is thoroughly built and equipped, as can be readily understood when temperatures are kept so evenly that the records show that many rooms filled with goods have been kept for months without the variation of a single degree. The office contains also an American Watchman's Time Detector, made by the Cleveland Electrical Manufacturing



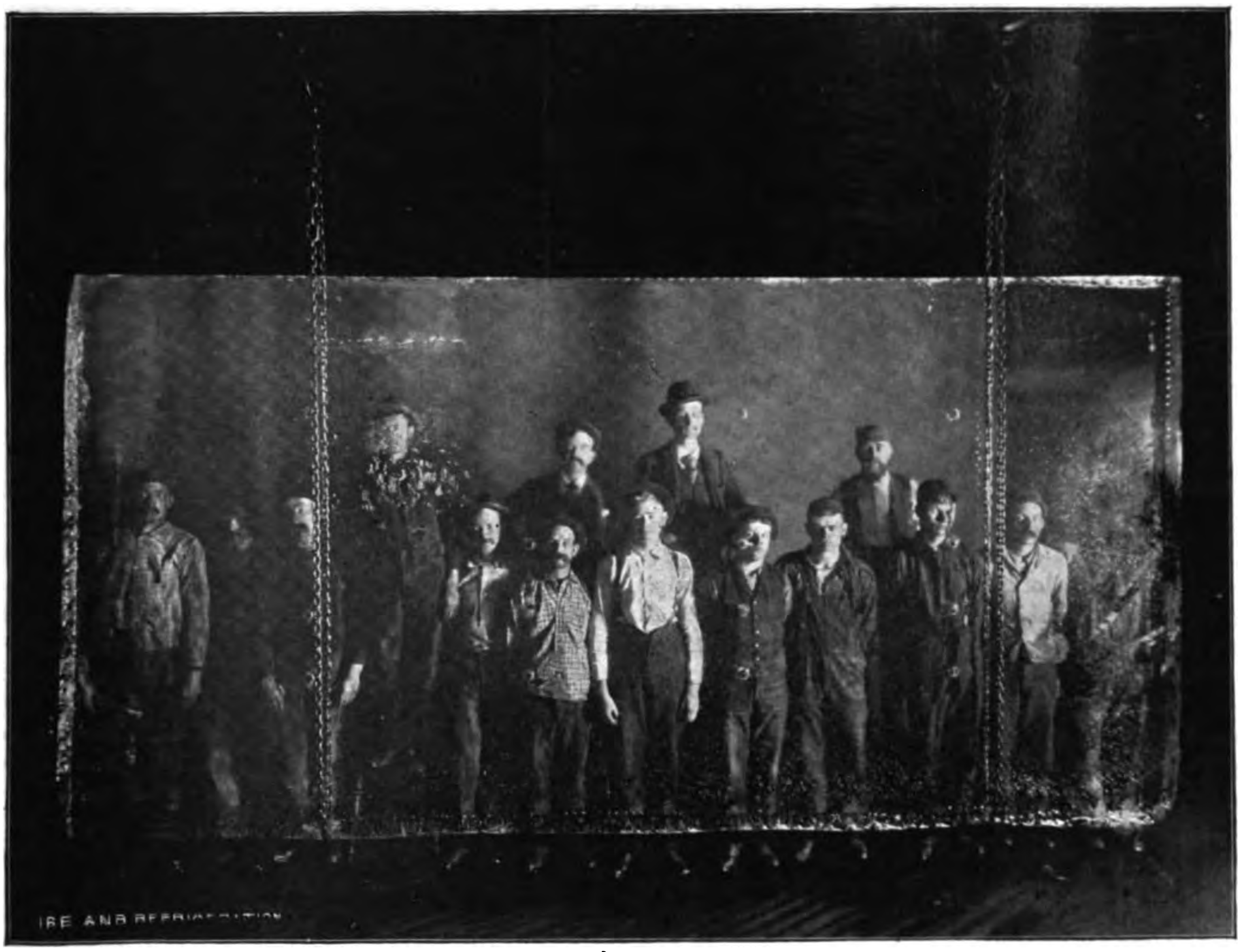


FIG. 11.—EAST ST. LOUIS ICE AND COLD STORAGE CO.—ENTIRE CREW OF THE PLANT STANDING BEHIND A CAKE OF ICE.

Co. The rooms are kept at temperatures varying from 40° to 6°, according to the needs of the various commodities in store, which embrace everything that was ever put in cold storage.

Among the illustrations of this article are some pictures of fancy decorative designs in ice which indicate the artistic management of the East St. Louis Ice and Cold Storage Co. One of these pictures is that of one of the tables at the banquet of the St. Louis Club given in January last, which were decorated by a magnificent vase six feet high cut from a solid block of ice, which is seen in the center of the picture. The table on which this unique vase stood was flanked on either side by smaller tables, each ornamented with a punch bowl of ten gallons capacity, which also had been cut from solid blocks of ice. In taking the photograph for this illustration it was impossible to show both the vase and the bowls, and the latter were omitted as of minor effect compared with the vase. The second design is one that was placed in front of "Tony Faust's" Fulton Market during the holiday season of 1893, of which the St. Louis *Star-Sayings* of January 1, 1894, under the heading of "Rock of Ages in Ice," says: "A unique and beautiful design in ice has been placed in front of Faust's Fulton Market, 112 South Broadway, which is admired by every passer-by and is worth a journey to see. It is the symbol of the Christian faith throughout the world—the Cross; and the purity of the crystal material of which it is made is in keeping with what it represents. The style selected for this Christmas Cross is known as the 'agonized form.' It stands about twelve feet high upon a series of graduated bases, the foundation of which is six feet square and the top of proper proportion to receive the Cross, which is twelve inches square and five feet in height. Each tier of the foundation, as well as the Cross itself, has the appearance of a solid piece of ice, and since being laid one upon the other they have become so perfectly joined that the whole design has the appearance of having been chiseled out of the solid block by an artistic workman. The base and Cross are wound with smilax and holly, which produces a pleasing effect. It was designed and made by the East St. Louis Ice and Cold Storage Co., and made from their own product, and it will remain in front of Faust's Fulton Market on Broadway through this week." The credit for the designing and carving of all these decorations is due to Mr. Scholl, the general superintendent of the company, in the execution of which he has shown clearly that he has a thoroughly artistic nature and that his art instincts and his mental accomplishments are not limited to the successful erection and operation of ice factories.

FIG. 16.—EAST ST. LOUIS ICE AND COLD STORAGE CO.—INTERIOR OF A FREEZING OR CHILL ROOM.

IT is, in some persons' opinion, an "awful" situation, that which prevails at Augusta, Ga. The ice manufacturers at Augusta have been for some time past running their business apparently for some other persons' than their own health. Lately they concluded to try

something else, and agreed to sell ice at a given price. According to this agreement, as a correspondent telegraphs: "If the retailers violate the agreement with the factories they can't get ice from the companies. The retailers have no redress, for they say if they were to bring ice to Augusta from other cities, the pool companies would undersell them and knock them out of the trade." Now really this is too bad—too awfully, awful bad! Because, you know, here are a lot of enterprising individuals, whose sole investment in the ice business is that required for the purchase of a crazy wagon and a blind mule, who have the nerve to rush off to the newspapers and raise a howl of monopoly, trust, outrage on liberty, etc., *ad nauseam* because forsooth they find an impediment in the way of their wrecking a business that represents thousands of dollars of fixed capital in plants. It does seem as if the newspapers of the South ought to have sense enough to see that nursing and encouraging this sort of complaints must lead ultimately to the destruction of the whole ice making industry of the South.

FIG. 15.—EAST ST. LOUIS ICE AND COLD STORAGE CO.—MAIN HALLWAY LEADING TO COLD STORAGE ROOMS.

FIG. 10.—EAST ST. LOUIS ICE AND COLD STORAGE CO.—CAKE OF ICE 10 FEET LONG AND 13 INCHES THICK.

TRADE CORRESPONDENCE.

FROM THE CITY OF MEXICO—A TIMELY SUGGESTION—A QUERY FROM QUEENSLAND.

[The publishers of ICE AND REFRIGERATION do not hold themselves responsible for the opinions expressed by correspondents on any topic; but these columns are at all times open for the discussion of subjects of interest to the trade, and such correspondence is at all times welcomed. Our readers are cordially invited to contribute to this department by giving their views on questions propounded, or by suggesting original topics for trade discussion, or notes on the condition of trade in their section of the country. Anonymous letters will receive no attention whatever.—ED.]

FROM THE CITY OF MEXICO.

To the Editor: Our machinery for ice making produces twenty-five tons of ice per day; but the daily consumption for this city and some other few towns which send us orders does not exceed from six to eight tons daily in hot weather and four to five tons in mild weather. The chief use of our product is for the refrigeration of cellars.

The wholesale price is 15c. per twenty-five pounds. It is also sold at retail at various depots, from which it is distributed through the city and to private houses at 24c. per twenty-five pounds. At one time we wished to find out if it were possible to increase the consumption, and to that end we reduced the price to 12c. wholesale and 16c. per 25-pound piece at retail; but we found it was not possible to get a better market, the consumption remained the same.

At a distance of twenty to twenty-five leagues we have three great mountains, Popocatapetl, Istaccihuatl and Nevado de Toluca, which are always covered with natural ice, the supply of which is inexhaustible. It is impossible to calculate the millions of tons which lie on their peaks and sides. Besides these, to the eastward about fifty leagues, is the giant peak of Orizaba which also is covered with eternal ice and snow, as are the other mountain peaks at even greater distances from this city. From these sources the towns near by and near the sea supply themselves, though only small quantities are used, the trade in most places being next to nothing, and all efforts to increase the trade have thus far been without success. The mountain ice is not clear and contains a large amount of oxygen; moreover it contains many solid impurities, such as leaves, earth, etc.

P. SERRANO,
MEXICO, March 26, 1894. *of Pedro Serrano & Cia.*

A TIMELY SUGGESTION.

To the Editor: After noting the contents of your valuable journal (April), we regret to find that our Capitol City (Lincoln, Neb.) has recorded the lowest prices as a basis of their season's business, and close their quotations by saying, "these are starvation prices," which is well said.

I enjoy very much reading the comparison of prices quoted from the large number of cities, and think this an important publication to the natural ice dealers. If all dealers would subscribe for ICE AND REFRIGERATION, and keep posted on what prices are being made in the different cities, and note how many companies are compelled to quit at points where low prices are quoted, they would try to mend the little difficulties between themselves instead of taking them to the public, who only delight in such fights as long as it gives low-priced ice, even though it be at the expense of the business men.

J. A. DOE, *Manager*,
OMAHA, NEB., April 5. *South Omaha Ice and Coal Co.*

A QUERY FROM QUEENSLAND.

To the Editor: We notice in the January number of ICE AND REFRIGERATION an article on the decomposition of ammonia. The chemical we employ in our ice machine is sulphurous dioxide (SO_2), and we should be glad to learn whether in any previous number of your paper this refrigerant has been treated on; or, if not, whether you have this in view for a later article. If not already arranged for, we trust you will see your way to include this compound in such a valuable and instructive course as the one in question. A considerable number of machines in Australia, chiefly in Victoria, are using this chemical, and it would no doubt prove profitable to the proprietors of such (and we trust they are on your list of subscribers) to have this article's merits and demerits fairly expounded. They would thus have an apportunity of comparing the safety, efficiency and expense of the various refrigerants in most common use, and with a view to the further expansion of the ice making and cool storage industries, selecting the most suitable class of machine for their particular requirements. If some earlier issue of your paper contains the information we require, kindly forward same, if procurable, by first mail. Trusting to be favored with your early reply,

JAMES FAIRLIE & SONS.
MARYBOROUGH, Queensland, Australia, February 13, 1894.

[We do not remember of having specially considered the decomposition of sulphur dioxide (SO_2) as used in refrigerating machines, so far, in our columns. However, we may say briefly that this substance is not decomposed at any of the temperatures obtaining in refrigeration except in the presence of water, when sulphuric acid is formed, which corrodes the metallic parts of the plant wherever it comes in contact with them. To prevent the access of moisture to the sulphuric dioxide is therefore the principal consideration. We shall have an opportunity to treat this matter more fully in ICE AND REFRIGERATION.—ED.]

ICY ITEMS.

——Jacob Meyer has purchased the Sehring ice business at Lemont, Ill.

——F. P. Davis has purchased the ice business of Dolloff Bros., at Newport, Vt.

——G. J. Babson has bought the ice business at Foxcroft, Me., of Elijah Norton.

——E. Lincoln has purchased the ice business of E. L. Davis, at Putnam, Conn.

——John Favisernce has sold his interest in the Ashland Ice Co., Ashland, Wis., to Fred Sargeant.

——The Wallum Pond Ice Co., Pascoag, R. I., has elected Richard Smith president, and Wm. Manchester treasurer.

——The plant of the Americus (Ga.) Refrigerating Co., which cost $50,000, has been sold to A. & N. M. Block, of Macon.

——Daniel Aitken, formerly of the firm of Aitken & Page, has purchased the ice business of Mrs. T. V. Brown, at Cohoes, N. Y.

——The Manistee (Mich.) Ice Co.'s ice houses have been purchased by J. Madison, who will supply all the customers of the old company.

——Messrs. W. E. Worth & Co. have bought out the Orton's ice business, including the ice warehouse at the foot of Ann street, Wilmington, N. C.

——The West Mill Co. have disposed of their ice business at Gloversville, N. J., to Seymour & Co. The latter have secured a five years' lease of the plant.

——Joseph White and John Nadeau have purchased the ice housed by C. W. Bradley at Rochester, N. H., and will conduct that business during the coming season.

——The Ogden (Utah) Artesian Ice Co. have surmounted their late legal troubles and the plant is being thoroughly overhauled preparatory to resuming operations.

——On April 10, the Corryville Ice Co. plant, Corryville, Cincinnati, which cost $175,000 to construct, was sold at receiver's sale to the Stone Lake Ice Co. for $67,000.

——The Consumers' Ice Co., of Sandusky, Ohio, has elected C. L. Wagner president; vice-president and general manager, C. L. DeWitt; secretary and treasurer, J. C. Leser.

——Parshall Ice Machine Co., Chicago, has been licensed to incorporate; capital stock, $10,000; incorporators, Charles H. Parshall, J. H. Breckenridge and M. C. Rasmussen.

——The property of the Hannibal Ice Co. was transferred March 28 to the Creve Cœur Ice Co., of St. Louis. The transfer embraces several ice houses partly filled and some real estate.

——R. N. Boak has sold to Chas. F. Tiedemann a one-half interest in the Crystal Spring ice property, Middletown, N. Y., and Boak & Tiedemann have formed a co-partnership for carrying on the ice business. They have a good stock of ice on hand.

——H. A. Orth, of Harrisburg, has purchased from the Mt. Gretna Ice Co., Lebanon, Pa., the ice house and dam situated on the north side of the C. & L. railroad, between Colebrook and Mt. Gretna, including cars, machinery and appurtenances. The purchaser is a successful ice dealer in Harrisburg.

——The remodeled plant of the Alexandria (Va.) Ice Works at the foot of Cameron street began operations April 5. The electric light plant for the works will soon be installed, being the only building in Alexandria lighted by electricity except the office of the electric railway on Fairfax street.

——It is reported that the late Consolidated Refrigerating Co., of New York city, recently transferred its pipe line patents and franchises to the International Cooling Co., of 32 Pine street, New York city, and that the latter contemplates securing the contract for supplying the West Washington Market with pipe line refrigeration, if the city comptrollor will award the privilege at a reasonable figure. The previous comptroller demanded $10,000 for the privilege, and it is to this and the mismanagement of the old Consolidated company that its disastrous failure is stated to have been due.

ICE AND REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION, THE TEXAS ICE MANUFACTURERS ASSOCIATION AND THE FLORIDA ICE MANUFACTURERS ASSOCIATION.

.·. MAY, 1894 .·.

RATES OF SUBSCRIPTION.

IN ADVANCE, POSTAGE PREPAID.

United States, Canada and Mexico, - - - - - $2.00 a Year

All other Countries, - - - - - - - - 3.00 "

Single copies 25 cents. Advertising rates on application to the offices. Remittances must be made by post-office orders, postal notes, international money orders, checks or drafts on New York, Chicago or London, payable to H. S. RICH & CO.

H. S. RICH   S. P. FOWLER   J. F. NICKERSON   JNO. GLENN COLLINS

H. S. RICH & CO.

PUBLISHERS,

177 La Salle St., Cor. Monroe, CHICAGO.   206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

*** ICE AND REFRIGERATION, at the World's Columbian Exposition, received a medal and diploma for editorial, typographical and artistic excellence—the highest award given to any trade journal at that Exposition.

*** ICE AND REFRIGERATION is issued promptly on the 1st of each month. The first advertising forms go to press on the 20th, and the last on the 27th or 28th. Changes in advertisements should be sent in before the 20th.

INDEX TO ADVERTISERS.

A FEW MORE.

IN making renewals of subscriptions for 1894, a few of our readers have appended a word of encouragement; and we beg leave to return our thanks to the writers of the following:

[WM. LEE CHEND, of WESTINGHOUSE, CHURCH, KERR & Co., Boston.]

We find your paper so readable and instructive that we are disposed to make our files complete.

[OTTO BARTH, Chief Eng., SCHMULBACH BREWING Co., Wheeling, W. Va.]

Inclosed find price for ICE AND REFRIGERATION another year. I feel as though I could not give it up for twice the price you ask for it. I am much pleased with it, and I obtain much information by reading it.

[LOUIS E. BEALL, Uniontown, Pa.]

The Hygeia Crystal Ice Co. can attest to the commercial importance of ICE AND REFRIGERATION as a medium which is worth to any ice manufacturer or dealer a hundred times the cost of subscription. We simply would not be without it. We wish you most sincerely every success.

[UTICA C. S. AND WAREHOUSE Co., Utica, N. Y.]

Although we do not always agree with the writers of some of the articles published, we do not hesitate to acknowledge that ICE AND REFRIGERATION is a most valuable paper.

THE editor of ICE AND REFRIGERATION desires to remind the trade that correspondence is invited from every reader who can give the ice trade in any part of the country any information relative to the business in any of its branches or departments. This journal is designed to be a medium of communication between the individuals composing this great industry, through which both manufacturers, wholesalers and retail dealers can express their views and present facts relative to their own trade as a part of that of the whole country. Discussions of mechanical questions and problems are also invited and opposing views to those of the editor or of contributors are particularly desired and invited. In a multitude of counsel there is wisdom. In one way, the value of a trade paper to the individual is largely of his own making. Therefore, honored reader, "Let your light shine before men." "See?"

SEVERAL of the New Orleans ice factories have recently entered into an agreement whereby the sale of their combined output will be under one management. Under this arrangement they expect to be able to give a more efficient and satisfactory service to the public, as well as to reduce the expenses of conducting the business. The plants affected are: The Consumers' Ice Co., Municipal Ice Mfg. Co., Southern Ice Co., and the two factories of the Crescent City Ice Co. This includes all of the New Orleans ice plants, with the exception of the New Orleans Mfg. Co., owned by Mr. J. M. Beath. The sale of the combined output of the above-named factories will be under the management of Mr. Louis P. Hart, of the Crescent City Ice Co.

ANSWERS TO CORRESPONDENTS.

TO DETECT AMMONIA IN WATER—EFFECT OF SALT WATER—CALCULATIONS EXPLAINED—COOLING ICE BOXES.

[This department of ICE AND REFRIGERATION is conducted for the benefit of the trade generally, as well as individuals; and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

TO DETECT AMMONIA IN WATER.

To the Editor: Will you please inform me as to the best way of detecting ammonia in water, and oblige, L. M. O.

ANSWER.—To detect the presence of small quantities of ammonia in water, brine, etc., it is best to add to a small quantity of the water contained in a small glass vessel a small quantity of Nessler's solution, when a yellow coloring will indicate the presence of a trace of free ammonia, as well as ammonia of salts. The presence of larger quantities of ammonia will give a brown precipitate or coloring. Nessler's solution is a reagent frequently used by chemists, and may be prepared as follows: Dissolve fifty grains of potassic iodide in fifty c. c. of water and add to this a concentrated watery solution of chloride of mercury, until a slight red precipitate remains after shaking. To the cleared solution 150 grains of caustic potash, dissolved in 300 c. c. of water, are added, and the whole diluted to 1,000 c. c.

EFFECT OF SALT WATER.

To the Editor: Will you inform me if salt water mixed with aqua ammonia in a machine does any harm more than make it form in the retort? Is there any way to get it out? I had a small leak in the coil in the ice tank and when I shut down the pressure leaked out and a vacuum was formed and ran into the coil some of the brine. What can I do for it? D. I. C.

ANSWER.—While we are not able to point to any special serious harm which the presence of salt brine might work in the system in the regular run of things, we nevertheless think it should be kept out. It does not belong there, and possibly may do damage in case of certain complications. There is, however, no way of removing the salt solution short of removing the whole charge of liquid contained in still, absorber and heater, and replacing the same with a weak ammonia liquor of equal strength. It is not required that the fresh ammonia liquor should have full strength, for the reason that the ammonia contained in the condenser, receiver and cooler need not be disturbed, and is thus preserved in the system.

CALCULATIONS EXPLAINED.

To the Editor: 1. In ICE AND REFRIGERATION of May, 1893, in answer to P. & B. as to capacity of $5\frac{1}{2}\times 9$ inches ice machine you give formula $\frac{0.116\times 75\times 60\times 24}{6}=2.0880$. Will you please tell me what the divisor 6 means, and where you obtain it? 2. Also explain $543.2-(68\times 1.1)=468.4$ units. What does 543.2 represent? 3. We have in this town a single-acting duplex direct connected machine rated at five tons refrigerating capacity. While this machine is running the frost collects on gas return pipe and also extends all over the base of pump; at present there is in brine tank 900 feet 1-inch pipe; what I wish to know is if we put more pipe in tank, do we not get more work out of the machine? 4. My idea is that with more cooling surface in tank, there will not be so much frost collect on machine. It seems to me that this frost on machine represents so much fuel expended for nothing. Size of pump, 5×12 inches, ninety revolutions. Condenser gauge pressure, 140 pounds, back pressure, 20-pound gauge, 450 feet 1 inch pipe in condenser. Please answer at your earliest convenience. Will you also tell me how to calculate the necessary amount of pipe to put in condenser and expansion coils per ton ice making capacity? Express your answer in square feet of pipe surface. W. N. L.

ANSWER.—1. The divisor 6 stands for the number of cubic feet of saturated ammonia vapor which will make a pound of that substance at 19° F., this being supposed to be the temperature in brine coils in the example cited by you. This divisor is readily obtained for different working temperatures by referring to table of physical properties of ammonia, published in Vol. III, page 194, of ICE AND REFRIGERATION.

2. The number 543.2 represents the heat of vaporization or latent heat of one pound of liquid ammonia, expressed in thermal units, at a temperature of 19°, *i. e.*, the temperature in brine coils in example cited. This quantity is found likewise in the table mentioned under 1.

3. The amount of pipe (900 feet 1-inch pipe) should be sufficient for five tons "refrigerating capacity" in the meaning of the latter term as usually understood. If by refrigerating capacity, however, you mean ice making capacity—and this seems to be the case, judging from the figures you give under 4—then the above amount of pipe is not enough, but should be almost double that, say 1,800 feet of 1-inch pipe. The capacity of the machine would be considerably increased in that case.

4. The frost on return pipe, etc., does not necessarily represent a loss or waste of labor. In a properly working and otherwise justly proportioned machine it indicates that the same is working with moist ammonia, which is rather an advantage than otherwise.

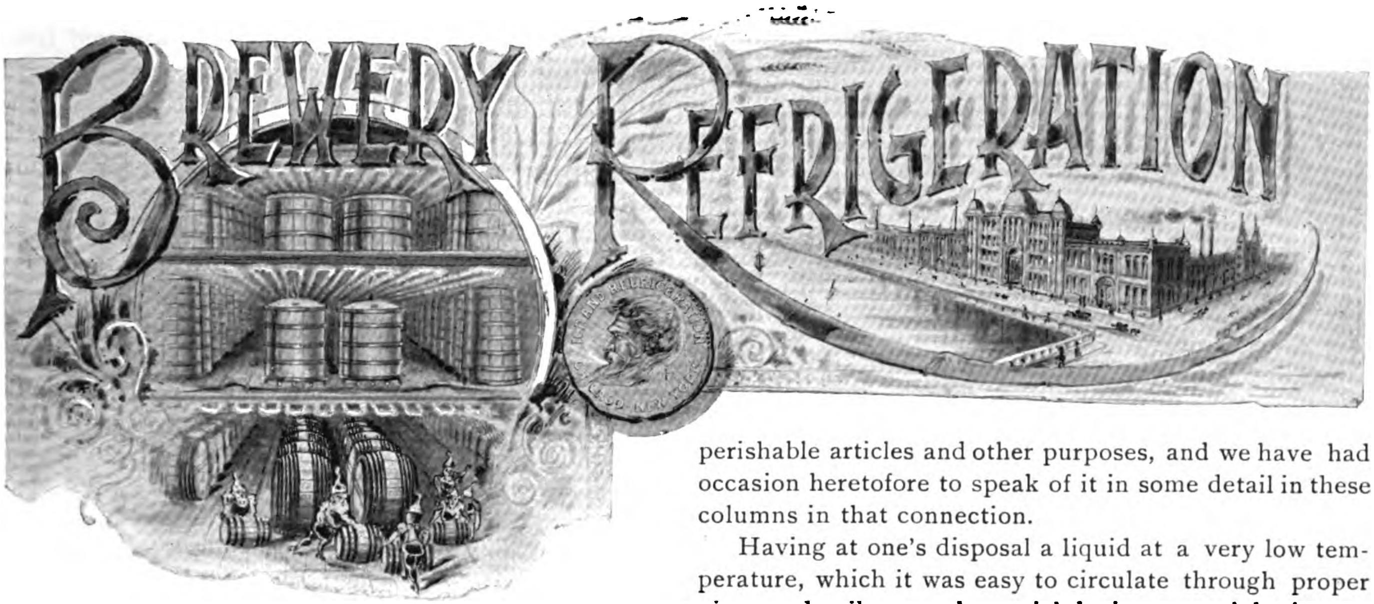
5. About 375 feet of 1-inch pipe are generally allowed per ton of ice making capacity in expansion coil, and at least 125 feet of 1-inch pipe in condenser coil. This is the most convenient way to express it, as it is more readily convertible into other size pipe than square feet measure. However, if you prefer the latter, we trust you can readily make the conversion.

COOLING ICE BOXES.

To the Editor: Will you kindly inform me in your valuable paper, (1) the cubic feet of space allowed to one square foot of cooling surface for brine and direct expansion, according to best modern practice for temperatures from 25° to 30° and 32° to 38°; the boxes being in constant use for general storage, size of boxes ranging from 1,000 to 2,000 cubic feet? (2) What is your opinion as to arrangement of pipes in coil loft or on sides of box for giving best results? J. L.

ANSWER.—In order to compute the exact amount of pipes for your ice boxes, the temperature of brine and of ammonia should be known; if both are the same, there will be no difference in the amount of pipings between brine and direct expansion. The opening of doors of boxes also has considerable influence, and if this happens very frequently, about twelve cubic feet space for each square foot of cooling surface would be considered a fair allowance for temperatures between 32° and 38° F. For the lower temperatures 25° to 30°, we think it would be safe to increase the cooling surface some 50 per cent. Regarding the location of refrigerating coils, we would prefer to place them overhead under the ceiling if it were only to save wall space; moreover in that position they are not so liable to be struck by the draft on account of an open door, etc.

AN esteemed correspondent suggests the advisability and desirability of holding a national convention of ice dealers. ICE AND REFRIGERATION would, of course, like to see an association formed to hold such a convention; but really for genuine practical value to the ice trade, city, county and district organizations would be of incalculably more value. Get the local associations first; then the other will come of itself.



[*Written for* ICE AND REFRIGERATION.]

BREWERY REFRIGERATION.

ARTIFICIAL REFRIGERATION AS NOW PRACTICED IN BREWING PLANTS —THE ORIGIN AND DEVELOPMENT OF THE FAMILIAR BRINE SYSTEM OF REFRIGERATION.

BY AUGUST J. ROSSI, B. S., C. E.

[*Continued from March issue, page 169.*]

SIMPLE and economical as may have appeared to the brewer from the start the system of refrigeration just mentioned, even when the mechanical means for producing cold artificially had not reached the state of improvement which they did afterward, he must have been led very soon to avoid employing the intermediary of cold water, which could not in any case reach a temperature lower than 32° F., and to stop taxing the machine by making a product which was not to be used in its solid state, but which was to be melted, almost as soon as formed, in the very mass of liquid in which it was frozen, even if by such practice the absorption of latent heat produced by the machine was fully restored by this melting. How much simpler, and especially how much more rapid, it must have appeared to apply directly the cold generated by the action of the machine to lower to any degree that could be desired a certain mass of practically non-congealable liquid which could furnish a vehicle of cold, ready to exchange its temperature with the surrounding bodies, or such liquids as it would be brought in indirect contact with through metallic surfaces. With such practice the cooling action would be more immediate, more controllable as to intensity, and its application just as easy and clean as that of ice water, though much more efficacious.

THE BRINE SYSTEM.

These considerations led to many dispositions now adopted in a great number of breweries. Originating in these establishments at a date which it is difficult to ascertain—since the transition has been almost co-existing with the introduction of the refrigerating machines in breweries, but of which numerous examples could be quoted, here and in Europe, in the period extending from 1872 to 1878 or thereabout—this system of refrigeration by the circulation of cold brine, which is known as the "Brine or Indirect Method," has been for many years the one most exclusively in use. It was adopted early in cold storages for the preservation of meats and perishable articles and other purposes, and we have had occasion heretofore to speak of it in some detail in these columns in that connection.

Having at one's disposal a liquid at a very low temperature, which it was easy to circulate through proper pipes and coils or such special devices as might be required to obtain a desired effect by the simple action of ordinary water pumps, the principle was logically indicated of applying it to cool the sweet wort as it trickles down hot over the pipes of the Baudelots instead of using ice water, or to cool the liquids in process of fermentation, as well as the rooms in which such fermentation takes place or in which the manufactured product is kept—of circulating it through the coils of the Baudelots, the attemperaters or the piping in the rooms to be cooled, in such quantity that any desired temperature could be reached and maintained—in each case, at any proper degree, in the same manner as hot water is used in dwellings for heating purposes.

Following the comparison and the deductions it implies, in the same manner as it has been considered advantageous, or preferable sometimes, to circulate hot air in artificial heating, in artificial refrigeration it was natural to think of circulating cold air as an agent for the transmission of the cold; that is, instead of cooling the air itself of the cellars and fermenting rooms *in loco* by the passage of this cold brine in special pipes, it has been thought advisable, in certain establishments, to cool this air apart, in a distinct room, by appropriate contrivances by means of this cold liquid, and then to discharge it mechanically, once it is cold and thereby deprived of its moisture, in the rooms to be cooled. At other times this cold brine has been caused to circulate in pipes in an overhead room connected with the chill room proper by a number of air ducts; the difference in the specific gravity of the cooler and warmer air being depended upon to create the proper circulation. This cold brine, in certain establishments, has even been used to cool water to be circulated in the coils of the attemperaters in the beer during fermentation and sometimes in the Baudelots when such practice has been deemed safer. Examples of such usage, or some other similar to it, could be referred to in England and elsewhere during the period mentioned above, extending from 1872 to 1878. However, the cooling of the liquids in the brewery directly by cold brine, and of the cellars and rooms by means of piping suspended from the ceilings of rooms in bunches, or run along the walls, or both, has more generally prevailed in breweries, especially in this country.

Whatever may be the mechanical devices resorted to, or the type of refrigerating machine adopted, what char-

acterizes this method of refrigeration is the indirect utilization of the cold produced by the machine proper for obtaining a cold brine, *independent from* the volatile liquid employed as a primary generator of cold.

(TO BE CONTINUED.)

[*Reprint from* LONDON BREWERS' JOURNAL.]

BREWERY REFRIGERATION.

THE PRODUCTION OF COLD AND REFRIGERATION—AN ENGLISHMAN'S VIEW OF THE ECONOMIES OF MECHANICAL REFRIGERATION—HOW TO HANDLE THE WORT.

By W. STANLEY SMITH.

ONE day, searching among the ancient, dry-as-dust records of science which lie buried in the "Philosophical Transactions," we chanced to light upon the work of a certain Cavallo, a man who, be it spoken to his infinite credit, probably forged the golden key which opened the portals guarding our modern appliances for effecting cold. Cavallo, who writes in 1781, has shaken off the vague mystic phantom of material heat, a ghoul known as Phlogiston, which managed to effectually debar the progress of science for some nine centuries, and even engulf the giant intellect of Stahl. We know how, about the year 1743, chemist and tax collector Lavoisier slew, single-handed, this rampant monster, raised by the alchemist Geber, some thousand years before, and how the science of calorimetry was thus fairly set afoot. Let us, therefore, pay attention to our learned Cavallo, premising his experiments with the true dictum: Heat is not a material, but a quality. Into a certain small flask, fitted with cork and sufficiently narrow tube, cappillary as one calls it, Cavallo poured some ether. Inverting this flask, he tells us how the pressure of vaporized ether will drive out a fine stream from the capillary, and this stream, when directed on to a small vessel containing water, abstracts sufficient heat to cause the water "to become opake in consequence of the icy crystallization." It is in these words that we divine a basis for all subsequent research, and foundations on which rest the glories of modern refrigeration. So much for the ancients; we must proceed, in all haste, to a consideration of the principal phenomena and most urgent requirements connected with machines used for this artificial production of cold.

The act of refrigeration may be simply defined as the transference of heat from one body to another, the agent employed, in a commercial sense, being some chemical substance under unnatural conditions, which speedily assumes its own proper state on abstracting a sufficient number of calorics, or heat units, from surrounding material. The material which the brewer adopts for supplying this necessary heat is water, pure and simple, and on the efficient extraction of surplus heat depends his success in cooling worts during hot summer months. A numerical example will best illustrate the principle, so let us call to mind the hard fact that one pound of water at 60° F. contains an excess of heat, over and above a similar weight of ice, amounting, in round numbers, to 170 calorics, or heat units. From this it is plain that in order to reduce the pound of water at 60° F. to one pound at 32° F., it will be necessary to abstract, by some means or other, these extra 170 calorics. These means and methods will be considered later; suffice it to say the water is reduced in temperature to 32° F., or the same as the pound of ice. Strange as it may appear to the unthinking ones, the water will still be liquid, even though its heat be 32° F., for as pure water under ordinary pressure at 212° F. does not vaporize (under ideal conditions) until more heat be applied, even so will pure water be incapable of solidification at a temperature of 32° F. until more heat be abstracted. This heat, in either case, does not register on the thermometer, being what is termed "latent"—in the one case "latent heat of vaporization," and in the other "latent heat of fusion," a process of addition to boiling water and of subtraction from water at freezing point. Conversely, if we melt a can of ice, all the initially applied warmth will be used up in the form of latent heat, that is the heat necessary for converting the solid into a liquid, while the actual registered temperature during the whole process of liquefaction will be that of freezing point of water, or, as it may also be termed, the "melting point" of ice. The great principle involved in latent heat, and the one which causes us to dwell so much upon it, is as follows: The quantity of heat used up or absorbed in converting a liquid into a vapor, or a solid into a liquid, is identical with the amount of heat given up in reversing the processes. Take water again to illustrate the power represented as utilized in converting a liquid into a solid. The latent heat of water is known, by experiment, to be equal to 142.65 calorics for every pound of water, or, if we take the more practical ton weight, these figures will rise to 319,536 calorics (2,240 lbs. × 142.65). Now to simply reduce a ton of water from 60° to 32° F., (that is, through 28°) will require the abstraction of 62,720 units or 2,240 lbs. × 28. It is, therefore, as obvious as daylight that about five times the power is required to produce ice as to cool water down to freezing point. No better example of the economy of the English system of using cold water, instead of block ice, can be quoted than the above figures.

In selecting a suitable refrigeration agent many details have to be considered, for the principle on which most machines work is the evaporation of some liquid at a low temperature—whereby it abstracts the necessary heat—and the recovery of this liquid by subjecting its vapor to pressure and inducing its condensation. The question of latent heat is then of the utmost importance, and it becomes a matter of great nicety to adjust machines in order to get the utmost work out of them. As an instance of the great diversity of latent heat characterizing some of the best known agents of refrigeration, we give the following few details: The latent heat absorbed in changing the state of one pound of ether vapor is 162.8 units, alcohol vapor absorbs 364.3, while aqueous vapor and gaseous ammonia total respectively 966 and 900 units of heat. From these figures, combined with actual experiment, we deduce a law which teaches us that the production of cold is in inverse proportion to the latent heat absorbed, so that in order to produce one pound of ice it will be necessary to vaporize about 0.17 pound of water, 0.19 pound alcohol, 0.5 pound liquid ammonia, or 1.04 pound ether. It is scarcely necessary to point out that the chemical properties of substances which it is desired to make use of as cold producers must

be carefully taken into account; an ideal substance would be one which has no deteriorating effect on the materials of which the machine is composed, or, in other words, is absolutely incorrosive, and not given to eating away joints, or other unpleasant appetites. Further, a body capable of facile vaporization, exhibiting a low boiling point and vapor tension, or, speaking practically, a limited range of temperature at which vaporization can be easily accomplished; indeed, the high vapor tension of some otherwise suitable agents of refrigeration has necessitated extreme care in constructing machines. This point will be abundantly illustrated by some typical values. At a temperature of 76° F. the tension of sulphurous anhydride (SO_2) exceeds sixty pounds per square inch, that of ether seventy-eight pounds, methyl chloride (used, it will be remembered, in Moissan's classic experiments on the liberation of fluorine) somewhere near eighty-two pounds, while liquid ammonia at 76° F. possesses the high tension of 155 pounds per square inch.

In the construction of large machines it often happens that economy of working is hampered by the quantity of water necessary for the process of condensing the vapors which are under pressure. As a general rule, the colder the vapor the less pressure is required to condense it, a fact we may set in the form of a curve, in which certain temperatures corresponding to certain pressures are necessary for effecting liquefaction. When Faraday first tried his hand at liquefying gases, he was so successful that he was able to formulate a law stating every gas to be capable of condensation into liquid form; however, he found a stumbling block in the case of carbon-dioxide, the interesting reason for which was afterward made apparent, and consisted in the fact of the temperature being too high. Above 84° F. it is impossible to liquefy CO^2, and similar rules hold good for other gaseous matters. We cannot, however, go deeply into the great physical question of what are termed "critical temperatures" and "critical pressures." Suffice it, every gas has these two attributes, and that curves may be drawn representing their respective critical points. We do not propose to go into the merits or demerits of the various refrigerating agents on the market; it would, indeed, be dangerous ground to tread upon, as, doubtless, each has its own recommendations. Ether, sulphurous acid anhydride, carbonic acid gas, hydrous ammonia, and a particularly good agent, theoretically and practically, anhydrous ammonia, each holds its own, and have made the name and fame of many excellent manufacturers. What is known as the "binary absorption" system is also of great merit, and consists in utilizing a fact well known to chemists. It has been found that ether, formed either by the acids or their alcohol radicles, are endowed with a strange power of absorbing anhydrous sulphurous acid, the ordinary ether of commerce possessing this characteristic most markedly. One advantage of these combinations of ether and sulphur dioxide (but one, we do not hesitate to point out, which is handicapped by other disadvantages) is the extremely low tension of the mixture, so that the pressure on a machine when stopped will be practically nil. Indeed, in some cases, a vacuum is formed. The work on the engine is relieved by another species of work known as chemical affinity, and it must be conceded that economy of power is realized. Another favorable point is that ether-sulphur-dioxide only requires about a quarter of the amount of condenser water as does SO_2 alone.

Probably all the great breweries in the British Isles are now amply provided with refrigerating machinery, and, doubtless, as time rolls on and patents lapse, the smaller brewer will take unto himself some such useful aids to perfection. Prices are, at present, somewhat high, and this not alone from the great strength of materials and high-class workmanship necessary for engines destined to withstand the high pressure caused by some of the more general agents of cold production, but also from the fact that harvests must be garnered while the sun shines brightly, or, in other words, while patents and such like documents hold good and true. The practical brewer will, however, do well to remember one lesson which was taught by bitter experience when, some years agone, what we term "refrigerators" were introduced into general use. We refer to the great necessity of not skimping the time usually found beneficial for exposure of worts in the time-worn "coolers." Especially in sultry summer weather is this necessary, for, despite the new teaching anent bacterial prevalence in such seasons, it is a matter of absolute necessity for all worts to be thoroughly aerated on the large old-fashioned coolers. After this aeration is well and truly effected, the value of cold liquor, say at 45° F., comes in, and the whole worts may be run as quickly as possible into the fermenting vessels. We will not concern ourselves with the question as to which form of refrigerator is best, as each individual has his own choice in the matter and his own ideas on the subject. The space available for running the wort over is, of course, one of the more important considerations, and it has been geometrically argued that a circular refrigerator answers this requirement most fully. On the other hand, that work can be as quickly and effectually performed by using the horizontal or vertical designs of our leading makers, is a matter of every-day experience, and we believe that the straight type of this class of workmanship is less costly to make, and compares favorably in point of cold liquor economy. One cardinal virtue of these straight refrigerators is the ease with which they may be cleaned, inwardly and outwardly, it being obvious that any scale collecting inside the tubes materially hampers, by its non-conductibility, the passage of heat and cold through the tubes.

M. RICHE, at the request of the French government has recently made a study of the microbes to be found in ice. It was found that ice which to the eye is perfectly transparent, and apparently free from any sort of impurity, may contain more than seven times the amount of organic matter which is allowable in water for drinking purposes. One specimen of ice was found to contain 175,000 colonies of germs for each cubic centimeter (¼ dram). This specimen contained more than forty times the amount of organic matter allowable.

THE Massachusetts state board of health concludes, from investigations of artificial ice, that artificial processes of freezing concentrate the impurities of the water in the inner core or the portion last frozen, that the impurities are least if distilled water is used, that the number of bacteria in artificial ice is insignificant, under the prevailing methods of manufacture, and that the amount of zinc found in ice is insufficient to cause injury.

THE forty-fifth annual statement of the Cincinnati *Price Current* of pork packing in the west, issued April 12, shows the following: Total number of hogs packed in the west last winter, 4,884,000, an increase of 250,000 compared with last year; average weight, 248 pounds, an increase of 20½ pounds; average yield of lard, 36 pounds, an increase of 4½ pounds; mess pork made, 149,000 barrels, increase 38,000 barrels; other pork, 129,000 barrels, increase 55,000 barrels; lard made, 583,000 tierces, increase, 89,000 tierces. The aggregate packing in the west for twelve months ending March 1 was 11,605,000 hogs, a decrease of 785,000 as compared with that of last year. The stocks of hog products in the west March 1 were as follows:

	1894.	1893.
Sides, etc. (pounds)	135,000,000	120,000,000
Shoulders	27,000,000	21,000,000
Hams	88,000,000	75,000,000
Total meats	250,000,000	218,000,000
Pork (barrels)	138,000	136,000
Lard (tierces)	41,000	36,000

STATISTICS have just been received of the frozen meat from New Zealand for 1893, which show a slight increase on the trade of the previous year. The last six months exhibit a considerable decrease compared with the first half of the year. In the former period 569,389 carcasses of mutton, weighing 34,143,358 pounds, and 30,779 carcasses of lamb, weighing 1,151,139 pounds, and 24,890 pounds of beef were exported; while the figures for the year are: Mutton, 1,338,177 carcasses, 81,587,487 pounds; lamb, 481,677 carcasses, 17,752,150 pounds, and beef, 922,816 pounds.

VERY few people have any idea what rigid economy is practiced at the great slaughtering plants. Scientific men are constantly cudgeling their brains to devise valuable chemical properties and new compounds in materials heretofore wasted or imperfectly utilized, says the *Drovers' Journal.* The cross roads butcher who kills a few animals a week, throwing away a large part of the offal, must make a large profit on the meat sold, but modern utilization of by-products makes it so the slaughterer who does business on a large scale could much better afford to sell the meat without profit than to waste what the old-fashioned small butcher could not utilize. The packing business as at present carried on utilizes a great number of products which were formerly allowed to go to waste. For instance, the stomachs of hogs instead of being sent to the rendering tanks, are now used for the manufacture of pepsin. Pigs' feet, cattle feet, hide clippings and the pith of horns, as well as some of the bones, are used for the manufacture of glue. The paunches of the cattle are cleaned and made into tripe. The choicer parts of the fat from cattle are utilized for the manufacture of oleo oil, which is a constituent of butterine, and for stearine. Large quantities of the best of the leaf lard are also used for the manufacture of what is known as "neutral," also a constituent of butterine. The intestines are used for sausage casings; the bladders are used to pack putty in; the undigested food in the cattle stomachs is pressed and used for fuel; the long ends of the tails of cattle are sold to mattress makers, the horns and hoofs are carefully preserved and sold to the manufacturers of combs, buttons, etc. Many of the large white hoofs go to China, where they are made into jewelry. All of the blood is carefully preserved, coagulated by cooking with steam, then pressed and dried and sold to fertilizer manufacturers. All of the scrap from rendering operations is carefully preserved and dried and sold for fertilizers. Bones are dried and either ground into bone meal or used for the manufacture of bone charcoal, which is afterward utilized for refining sugar and in some other refining processes.

PACKING HOUSE REFRIGERATION NOTES.

——Armour and Swift will establish dressed meat coolers at Oshkosh, Wis.

——The Cudahy Packing Co. has completed the work of rebuilding its old storage house at Sioux City, which collapsed recently.

——The Cudahy Packing Co., South Omaha, is setting up a 150-ton refrigerating machine made by the Vilter Mfg. Co., of Milwaukee.

——The Bloomington (Ill.) Pork Packing Co. when it closed down had butchered a few over 15,000 hogs. It will probably run again for a time this summer, opening in August.

——The Union Stock Yards Co., St. Louis, intends to erect a complete pork and beef packing establishment, to cost complete about $250,000. It is expected that the plant will be completed in the fall and employ 150 men. Daniel N. Palmer is the company's manager.

——The Whitaker packing plant at Wichita, Kan., was bought April 3 at a receiver's sale by the Francis Whitaker & Sons' Packing Co., of East St. Louis, for $50,000, a company incorporated about three months ago under the laws of Illinois. The plant just purchased will be reopened speedily.

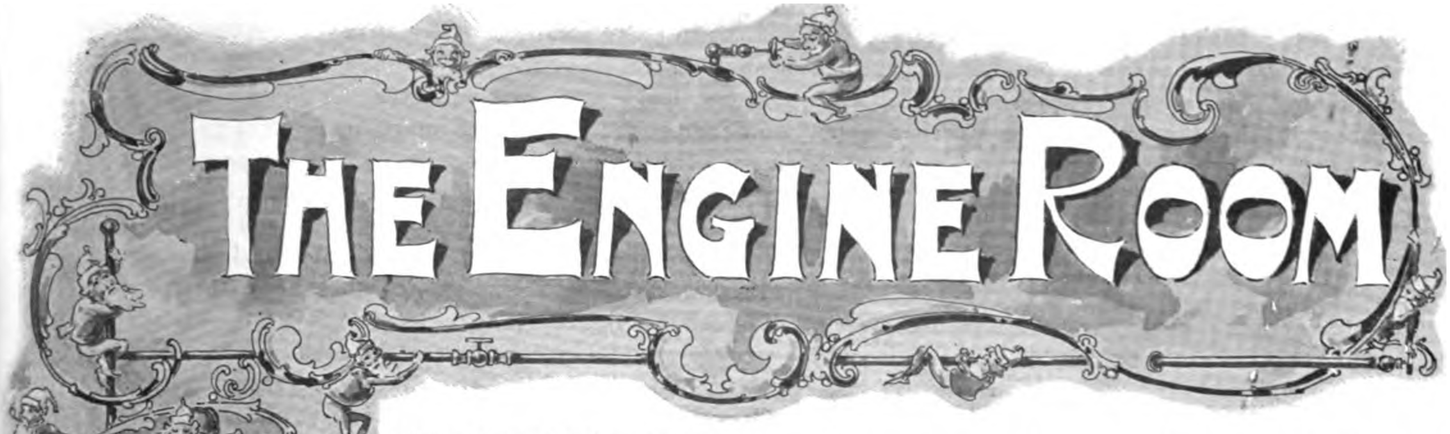
——Western Meat Co., San Francisco, Cal., has been incorporated; capital, $800,000; the company will deal in stock, slaughter, cure, pack, deal in same, and all products thereof. Promoters: Philip H. Lilienthal, Leon Sloss, Jesse W. Lilienthal, San Francisco, Cal.; Edw. Morris, Louis F. Swift, Chicago, Ill.

——The meat packing house noted as contemplated by Nelson Morris, of Chicago, at Baltimore, will be established by a joint stock company yet to be organized. Mr. Morris and Samuel W. Allerton, also of Chicago, will be interested, but it is said that Baltimore investors will hold most of the stock. The new company will probably have its packing done by the abattoir now in operation here.

——The annual meeting of the stockholders of the Lincoln (Neb.) Packing Co. was held March 25. The report of the president showed that 61,329 hogs had been killed during the year, and the sales of manufactured products ran considerably over $1,000,000. The surplus of the company was increased, and the record of the year was satisfactory. There is some prospect of the second packing house being opened during the present year.

——L. C. Pfaff & Son, New Haven, Conn., meat dealers, are erecting a cold storage plant which will be one of the largest plants of the kind in the city. A large three-story building located in the rear of the market is now nearly completed. Between this and the store will be the machinery building, in which the steam engine and boiler and refrigerating machine will be located. In the store there are to be six large refrigerators. The machinery will be of 5 to 10 tons refrigerating capacity. The building is built of brick and lined with wood, and will have six large rooms, and should be completed about May 1. It will be used by the firm in conducting their market and for keeping goods for other market men.

——The packing house of Samuel W. Allerton, Chicago, has been transferred to the International Packing and Provision Co., Limited, the price paid being $294,000. This adds this house to the smaller houses that have entered into a combination and are under control of an English syndicate, which includes all the small plants at the stock yards which are combined against Armour, Nelson Morris and the Swifts. The promotion of this last consolidation is in the hands of E. S. and Samuel White, of Liverpool, and Alexander Geddes and William Kirkwood, Scotch-American capitalists, packers and commission merchants. If their plans go through, the next move will be for the revival of the hog and cattle pool at the stock yards, under the operation of which competition for the daily receipts of hogs is stopped, the price each day being fixed by agreement, and the number going to each concern being prearranged by a system of percentages.



[*Written for* ICE AND REFRIGERATION.]

DRY vs. MOIST GAS.

AN INQUIRY FROM THE HONG KONG ICE CO., LTD., HONG KONG, CHINA—DIFFERENCE BETWEEN WORKING DRY AND MOIST GAS.

WE have to thank you for the unfailing regularity of delivery of ICE AND REFRIGERATION. We find it bristling with information which, isolated as we are here, is doubly valuable. Those late articles on gases in absorption machines have cleared up some of our difficulties, over which we had thought much. I wish you would give us a clear article on the difference between working dry gas and moist in a compression machine—by what means the liquid is carried to the compressor. Is it by a priming of the liquor in the refrigerator, or is it done by other means? Working dry gas as we do, in a compression machine, how is it possible to prevent ammonia becoming decomposed? Our cooling water is from 85° F. to 80°.

WM. PARLANE,
Manager Hong Kong Ice Co.

A body of vapor of any liquid, in this case ammonia, containing so much of the substance in gaseous form as can be supported in that state at the temperature at which it then exists, is called saturated. If an isolated body of a saturated vapor, say of ammonia, is heated, it becomes superheated, or dry, and the pressure increases correspondingly. If a body of saturated vapor is cooled down, a certain amount of ammonia assumes the liquid form, while the remaining vapor maintains a saturated condition corresponding to the lower temperature. If a saturated vapor is still in connection with the liquid from which it originated, or if it still contains parts of the original liquid in the form of small drops, or of fog, it is called moist or humid gas. If heat be transmitted to a body of humid, or moist, vapor it cannot superheat or become dry, since of the remaining liquid enough will evaporate to keep it in a saturated condition, and the larger portion of the heat transmitted becomes latent by the evaporation. If a compressor is filled with ammonia vapor just saturated (not moist) and the piston pushed forward, the work done by the latter in the act of compressing the gas is instantly converted into heat, which elevates the temperature of the gas, and incidentally also its pressure, to a degree far above that which would be due to the compression alone, as in the case when the heat created by the work of compression was carried off in some other direction. The latter may be accomplished, at least practically so, by the use of moist or humid gas. In this case the work done by the piston in compressing the gas is also at once converted into heat, but this heat does not all tend to elevate the temperature of the gas, but the greater part of the same is employed in converting a corresponding portion of the liquid ammonia (which is present in moist gas, as stated above) into gaseous ammonia. In this way the temperature during compression is kept down, and the pressure as well. For this reason, in the latter case, in the case of compressing moist vapor, the piston of compressor can travel much farther before the condenser pressure is reached in the compressor than in the case of compressing dry gas. In other words, the time during which the highest resistance has to be overcome by the compression piston during each stroke is much longer in the case of using dry vapor than in the case of using humid vapor. This of course means more work for the compressor (and a correspondingly larger amount of cooling water and fuel) in the case of dry compression as compared with moist compression; and the difference is quite considerable at that, amounting to some 10 per cent and more as a saving for fuel and cooling water. At the same time **the capacity of the compressor is somewhat increased by the fact of its being kept cool and therefore able to suck a larger quantity of incoming gas than a hot compressor would be.**

The process of using moist gas is a very simple one. It consists in opening the valves leading from the condenser to the refrigerator, wide enough so that more liquid ammonia will enter the latter than it is capable of evaporating. In this case the spent ammonia will enter the compressor in a moist condition. In order to be able to do this it is of course necessary to have an ample supply of liquid ammonia in the system to start with. While, theoretically speaking, every compressor may be made to work with moist gas, it seems, nevertheless, that one make may be better adapted for this system than another. Horizontal double-acting compressors appear to have an advantage in this respect, upright and single compressors requiring special packings and additional precautions in the working of moist gas. The same object that is accomplished by the use of moist gas may also be fulfilled, at least in a measure, by placing the compressor (upright) in a water jacket, kept cool by the circulation of cold water or by injecting oil (cooled artificially) into the compressor while the dry gas is being compressed. It would seem that the effect of moist gas is to be more direct in its action and more simple in its performance.

The principal safeguard against the decomposition of ammonia is the maintenance of a temperature in compressor and condenser as low as possible and as the means of attaining that end have been discussed, it will not be necessary to dwell on this point any further now.

[*Written for* ICE AND REFRIGERATION.]

CLEANING COILS.

HOW TO CLEAR COILS IN A BRINE TANK OF OIL—TWO METHODS SUGGESTED—A MATTER FOR EXPERT ATTENTION.

THE following query suggests an interesting topic, and the editor of ICE AND REFRIGERATION would very much like to have further volunteer suggestions, even though they may disagree diametrically from the opinions here expressed:

We wish to clean our ammonia coils in brine tank of oil, but the time for this work is almost too short, as we have considerable warm weather, and we do not think it advisable to take coils out. Will you therefore tell us if the following plan is feasible? We would pump ammonia out of the coils, then put 200 or 300 pounds air pressure on the coils and blow them out, allowing the brine to first have about 80° F. to soften oil some, without expanding rubber joints too much. After this we would fill the coils with strong lye (warm), let it stand over night to saponify the oil, then put on heavy air pressure again and blow out again, then fill with warm, clean water and blow off again, doing this several times; at last running a stream or current of heated air through to dry the pipes inside. Please give us your opinion of this method, pointing out any weak or bad points you may find.

R. B. C.

The way in which you propose to clean your coils is a very troublesome one, and we think of very doubtful expediency, some of the proceedings being evidently based on wrong suppositions. Thus if you use the proper kind of lubricating material there ought not to be any saponifiable fat in the coils; moreover, if your coils are packed with rubber, as some coils are, the strong lye would destroy these packings. For these reasons we do not think that your plan is well conceived, and we have never heard of such a method being followed to clean the pipes, nor do we think that it should be necessary to take the coils out or apart for this purpose, as you intimate.

The best way we know of to clean the coils is by letting high pressure ammonia gas into them; this warms the oil sufficiently to allow of its being drawn, mixed with the ammonia, into the compressor, whence it passes to the oil traps and is separated from the ammonia, which is ready for further use. In this way the coils can be cleaned in ten minutes, and if it is done often enough, say once every week, or, better still, every day or every other day, no oil will accumulate in coils.

Messrs. Westerlin & Campbell, refrigerating engineers, Chicago, to whom we had occasion to submit the above question subsequently, made the following interesting remarks on the subject:

"The only way to clean out ammonia coils in a brine tank, *without first removing the brine from the tank*, is to blow out with air pressure, care being taken to get the air as dry as possible. This at best would only remove loose oil and would still leave a coating of oil inside the pipes, with the chance of the air condensing in the pipes and leaving a deposit of water unless the brine is heated to 140°. We find that the only way to thoroughly clean out coils in a brine tank is to remove the brine from the tank, disconnect the headers from the coils, steam out each coil separately with dry steam, care being taken to let the steam blow through the coils long enough to heat them thoroughly, so that when the steam is shut off the coils are left hot enough to absorb all moisture inside. A solution of lye put in the coils, as your correspondent suggests, would leave some moisture in the pipes, no matter how well the coils are blown out afterward with air pressure, as all coils and headers have more or less traps in them, and these, of course, would retain some of the solution, and after the ammonia is put in they would do more harm than the oil which it is desired to take out.

"We would suggest that the correspondent employ some one familiar with the work to do what is required, or he may find himself worse off at last than at present, with time, labor and expense incurred for no beneficial results."

[*Written for* ICE AND REFRIGERATION.]

SOME DEBATABLE SUBJECTS.

EXCHANGE OF INFORMATION—DISCUSSION OF PRINCIPLES AND THEIR APPLICATION—INFORMATION DESIRABLE—HEATING OF MACHINES—MEANS FOR COOLING—CLEARANCE.

BY OTTO LUHR.

FULL and friendly discussion of a subject, when it is carried on in an intelligent manner, with the object of getting at the facts, is best calculated to bring out the full practicability of the subject and increase the knowledge of those who discuss it with the expectation of learning something more than they already know. One object of the articles that I have already contributed to this department has been to point out things of practical interest that will set my fellow-engineers to thinking, and will bring out in full the points of practical importance that are in the line of the engineer's duty, and which will give us all a little better understanding than we now have of ice and refrigeration machines.

I am gratified to find that some of my statements have been questioned, as that enables me to describe more fully just what is meant; and by explaining more fully each particular point that I have referred to a better practical knowledge will be obtained than though we simply made statements. By giving our reasons and backing them up with well known scientific data our information will be increased.

When special efforts are made to demonstrate a controverted point it is usually demonstrated, because that is the principal object of the effort. Such demonstrations generally prove little of practical importance, for they lack the conditions of practical work. Practical tests are those made during every-day work and without special preparation, and are reliable for that set of conditions only. Keep that in mind.

A further discussion of some of the subjects mentioned in my last article is made necessary by the following letter, which explains itself. The above introduction is to show the object of bringing up the different points with which every engineer has to deal who has charge of ammonia compressors, whether they be single or double-acting; whether using dry or humid gas should make but little difference, as his own interest should spur him on to understand one kind equally as well as the others. This is what we are ice machine engineers for. The letter referred to is as follows:

MR. OTTO LUHR:

Dear Sir and Brother.—I notice in your article in April number of ICE AND REFRIGERATION you speak of an association composed exclusively of ice machine engineers. I understand that

it is a sub of the N. A. S. E.; am I right? I belong to Merrick, No. 12, of Pennsylvania, located in this city, and I have been several years in the ice and cold storage business. Taking it for granted that you are also a member of the N. A. S. E., I would like to ask a little information on the subject of dry and humid gases that you spoke of in the same article.

Why is the De La Vergne the only double-acting machine that uses dry gas, and why is the gas any dryer for that machine, supposing it was worked on the same brine tank and the same length of suction?

Why will not a single-acting machine work humid gas as well as a double-acting machine and *vice versa*, both being submerged or water-jacketed cylinders?

How does the system for working humid gas differ from that for working dry gas, except one being a double and the other a single-acting compressor?

I have worked both horizontal and vertical double-acting machines, also single-acting machines, but could see no difference in the working of the gas or in the general arrangement of the system. I have worked both with so short a suction in the same plant that working our brine at zero, or near it, our machine froze back within four to six inches of the cylinder, and I could slow down and stop and then after a minute or two go ahead again without any trouble. I have also seen the De La Vergne machine run frosted clear back to the compressor cylinder, which I should think would cause the gas to be anything but dry.

Now, for the above reasons, I do not exactly understand your meaning, from the slight explanation you gave, therefore ask the previous questions, which you will do me a great favor by answering, either in ICE AND REFRIGERATION or by letter.

Yours fraternally,

PHILADELPHIA, PA., April 14, 1894. C. H. LLOYD.

I like that kind of a letter. It is honest and to the point. Such letters are characteristic of members of the N. A. S. E. The association of which I am a member is known as Linde Association, No. 38, of Illinois, N. A. S. E., located in Chicago.

In the statement about double-acting compressors and dry gas, reference was made to machines without water jackets, but by neglecting to mention this little fact the above question was raised and a fuller explanation will be desirable to others, perhaps.

In what is known as dry compression, where ammonia is the substance used, there must be some means of cooling the gas or the cylinder; for if this is not done many evil results will follow. No machine uses perfectly dry gas, for there is in the gas itself unless it be superheated about 7 per cent of moisture, and this is a great help in preventing some of the troubles that would otherwise arise.

DEVICES FOR COOLING.

All machines have been provided with some means for cooling the gas and keeping the temperature of superheat low enough to prevent injury to the machine and not decompose the ammonia by too high a temperature, although this point is not considered as fully as it should be. The De La Vergne does this by the use of oil in the compressor; some other vertical (single-acting) machines by ammonia, at the pressure in the returns, filling the cylinder at the stuffing box end, thus cooling the cylinder walls and one side of the piston while the piston is compressing the ammonia and developing the heat on the opposite side. A water jacket is used also on these machines. The cold ammonia gas drawn from the returns is sufficient for this purpose, if the frost is carried back far enough. This produces a churning of the ammonia gas to a slight extent. A somewhat similar method is employed in the Hercules single-acting machines. Others employ water for cooling where dry gas is used.

The reason why the De La Vergne is the only double-acting machine using dry gas is difficult to state with certainty, as there is no insurmountable reason why it cannot be done with other machines; but as there are some strong reasons advanced against it, they may account for there not being any more such machines. A man can work any compressor with dry gas, if he understands how to handle the machine, but there is the question of economy and practical utility to be considered.

CLEARANCE.

Clearance is a great detriment to any machine which is used for compressing gases or is operated by gas under pressure. In an ammonia compressor the loss of power and decrease of efficiency through the detrimental effects of too much clearance is fully as great as in a steam engine, and all suitable means are employed to overcome it. Clearance in a compressor means that a portion of the ammonia in the cylinder cannot be expelled at the end of the stroke, and remaining there it will expand and fill the cylinder at a certain pressure and prevent the entrance of that much ammonia. As this occurs at each revolution of the engine, or each active stroke of the compressor, that much work is lost. Consider the accurate workmanship required to produce a double-acting compressor that shall have a minimum of clearance; and after it is produced how long will it remain in that condition, or how long would it be before one or the other cylinder heads would be knocked out, or the engine be thumping in a threatening manner? I would not like to take care of such a machine, if any one was willing to pay the price of it.

Clearance is largely responsible for the existence of so many single-acting machines, which are made vertical so that the lost motion in the connecting rod brasses will not increase the danger of knocking out a head. The effects of clearance in a double-acting machine using dry gas are largely overcome by the use of oil.

It is much cheaper to pump around the amount of oil necessary to fill the clearance spaces than to compress a given amount of ammonia at each stroke and permit it to expand in the suction side of the compressor. Oil does not expand in this way. Oil fills the clearance in the wet compression cylinders also.

With a De La Vergne machine, working under similar conditions as another, the gas will be dryer, as a lower back pressure can be used, and consequently the brine can be made colder. But there is no economy whatever in such working, for the greatest economy is obtained when there is the least difference between the compressor pressure and that of the suction.

The De La Vergne is a slow speed machine; but when you freeze back, the oil in the compressor will get thick and many heads have been blown out from this cause, although it has been the fault of the engineer. Many machines escape this fate by reason of the safety valves inside of the compressor casing. They are put there for a pupose, and will be employed so long as oil inside the compressor is used for cooling.

Single-acting compressors, as they are now constructed, are not intended for handling gas containing much liquid, and could not be used successfully for such purpose, as the stuffing boxes with which they are fitted are not capable of holding the liquid. In such single-acting compressors as are now in use, the stuffing box is the lowest part of the compressor cylinder, and any liquid ammonia that might be present would find its way there; and with such stuffing boxes as these machines are equipped with, the ammonia would flow along the rod and the packing could not be made to hold, no matter how tight it might be run.

[TO BE CONCLUDED.]

[*Written for* ICE AND REFRIGERATION.]

PACKING PUMPS.

A QUERY AND A DISCUSSION ON THE SUBJECT OF PACKING AMMONIA PUMPS—WHAT DEAN BROS. AND WM. COOK SAY ON THIS IMPORTANT SUBJECT.

WE operate a 20-ton absorption machine, built in 1891, writes a correspondent from North Carolina. With this machine we got an upright ammonia pump. This pump has never given us satisfaction or good results. Recently we were induced to buy a "Dean" pump, which has given us very little better results. We have never been able to pack this pump so that it will not leak. We have used the —— packing, also have cut pure rubber, but of no avail; it will leak. Can you tell us why this is? C. I. C.

The Dean Brothers Steam Pump Works, Indianapolis, whose pump is referred to, have had the kindness to answer the above question at some length as follows:

"We have two styles of fly wheel ammonia pumps, differering only in manner of packing ammonia piston rod. One style has a lantern iron in stuffing box; the other has our sealed chamber. The pump referred to is the last named style of pump. It is 7×2¾×10, No. 6087, put out December 3, 1891. There is no difficulty in packing these pumps to keep them from leaking, or special skill required, or special kind of packing. Experience will teach one what to use.

"The piston rods of these pumps are made of high grade tool steel, turned and ground true, their whole length. In the pump referred to, to pack it, use Italian hemp packing, plaited. The user can plait it himself or buy it plaited. Then remove the cover of the sealed chamber, which exposes the inside stuffing box; after removing the nut and gland, fill the inside stuffing box full of packing. Pack it well in; not too hard. When you have all the packing in that the packing box will take, screw the gland and nut in place. If, when this is done, it indicates that the packing box is not full, remove the nut and gland again and put in more packing. Replace the gland and nut and screw well down; not too tight. If properly done the thumb and finger will screw the nut tight enough. See that the gasket is all right on the cover to the sealed chamber; put it in place and bolt down. Pack the outside packing box in the outside of the frame in the same manner. Put a little *good* oil on the piston rod and go ahead with your pumping.

"You will note the valve stem on the under side of a sealed chamber. This valve is in a part that leads from a sealed chamber into suction opening. While pumping have this valve open, so that should there be any leakage from inner packing box, it will be taken up by the pump. These pumps are intended to do this work at a speed of twelve to fifteen revolutions per minute.

"Tighten up your packing nuts from time to time; renew the packing occasionally. Don't wait for the packing to wear out or burn out, with the nut and gland jammed down, metal to metal, against the packing box, and then because it leaks, 'damn the d—— pump and the d—— outcast that made it,' but remember that the pump may have merit, and the fault may be the lack of knowing how to handle it. This pump may not be the only one of its kind running, and the other fellow may be running his pump without trouble. Ammonia at high pressure is nasty stuff to handle. It requires, besides good material and good machinery, good judgment.

"There are a great many packings made, all of which have merit. After finding the kind of packing suitable for ammonia, experience will teach one how to run it. In the case above, should the piston rod be cut or creased from the use of too hard packing, a new rod should be substituted or the old one trued up. Then pack as above, and then there should be no trouble to keep tight packing boxes."

Mr. William Cook, the well known refrigerating engineer, of Philadelphia, Pa., who has paid special attention to pump packings, says on this subject:

"I have tried a number of different kinds of packing for the ammonia piston rod of the Dean ammonia pump, and I find that if pure gum is properly used and the rod is not badly grooved or taper, it will keep tight and not give a particle of trouble if the following directions are observed: Take pure gum rings that will slip into the stuffing box easily, or with light pressure. Square or rectangular gum will answer if the rings are not convenient to get. Oil the rod and the rubber where it comes in contact with the rod, fill the box nearly full, so that the nut will screw on easily with the hand about one-half inch (do not use a wrench). Put oil on the rod when you start the pump; let the packing leak a little at first, as the ammonia will soon swell it up so that it will be tight, and the nut may have to be loosened a little. Be sure not to screw the packing tight, or it will bind the rod so tightly that it will roll it out of the stuffing box. After a day or two running, another ring may be put in, or it may not be needed at all. See that a few drops of oil are put on the rod every hour, or oftener if occasion demands; and be sure not to screw it up too tight. Rubber ¼ or ⅜-in. thick may be used. I have known this packing to run for an entire year of continuous running without renewal. It is best to use mineral oil instead of animal. I have used it on ¾-in. rods that were ⅛-in. less in diameter than the bore of gland, and have had no trouble with it. If your subscriber continues to have trouble, refer him to me and I will get him the proper size of packing, which I will guarantee to work properly. I have known a 20-ton plant to run for ten months with a loss of only one drum of aqua ammonia, and others to use as much as seven or eight. The loss is due to the quality of joints and the sort of attention they have. With ordinary attention and good joints, with the ammonia pump properly packed, the loss should not exceed four drums for ten months' run." [Several packings, made especially for ammonia pumps, are advertised elsewhere in this paper.]

THE following recipe for stopping leaky steam pipe joints is given by an engineer: "Five parts of plaster of Paris, five parts of yellow ochre, ten parts of litharge, five parts of red lead, and four parts of black oxide of manganese. To these powders, which should be mixed thoroughly, a small amount of asbestos powder and boiled oil is added. The cement hardens in from two to five hours."

THE Mason City, Iowa, "egg house" which in January last "dropped" $9,000 on one lot of eggs to New York, will have the sympathetic consideration of the trade. Eggs have been "awfully oph" this season—as uncertain as wheat to a "bull."

THE ICE TRADE

[*Special Reports to* ICE AND REFRIGERATION.]

THE PRICE LIST.

SUGGESTIONS FOR IMPROVED AND MORE CORDIAL RELATIONS BETWEEN INDIVIDUAL MEMBERS OF THE ICE TRADE—MORE QUOTATIONS OF RETAIL PRICES.

THE prices quoted below, with those quoted in the April issue of ICE AND REFRIGERATION, give a very comprehensive review of the ice market for the opening of the season of 1894. In the main, the prices, if maintained, will prove remunerative if the season is of average length.

It is perhaps true to say further that there is a more cordial feeling in the trade than was observable a few years ago. One would be sorry to say that this feeling is superficial and born of a spirit of self-defense, for there is no possible reason why this should be so; yet too often it is so. If one stops to think of it, a reasonable man would be puzzled to tell why two men in the same line of business should not be cordial, not to say friendly, in their relations, especially when cordiality would be profitable to both. However, human nature is—human nature.

Nevertheless, if one were to suggest the simplest, the most practicable, and never failing remedy for demoralized prices and general unprofitableness of the retail ice business, it would be: Let dealers cultivate the amenities of business life and exhibit that confidence in each other that exists between the ice dealer and the grocer, or dry goods dealer, or the banker, or real estate agent. When that happy condition obtains, the ice trade can be made as solidly and as surely profitable as selling any other material or product which is essential to the welfare and comfort of the people. We may, as individuals, be able to suggest other remedies and other methods of arriving at the desired result, but the foundation of any rational scheme must be mutual confidence; and there is no better suggestion to make to the trade than to cultivate that confidence, coupled with the self-evident and axiomatic truth, that no man ever made money handling ice or any product at a price only equal to or below cost.

We desire here to return our thanks to all who have contributed data to these reports; and to ask that any further suggestions which may occur to the reader in this connection will be sent to us for publication for the benefit of the trade.

QUOTATIONS OF PRICES.

CANADA.

Hamilton, Ont.—Grant-Lottridge Brg. Co.: We obtained prices from one dealer here at $1.50 per ton f. o. b. Hamilton; retail, about $4 per ton delivered to customers.

Ottawa.—Independent Ice Co., Levi Booth, manager: Prices for the season (May 1 to Sept. 30): 10 lbs., daily, $5 (same per month, ice on sidewalk, in advance, $1.25); 20 lbs., $8; 30 lbs., $11; 40 lbs., $14; 50 lbs., $17; 60 lbs., $20; 70 lbs., $23; 80 lbs., $26; 90 lbs., $28; 100 lbs., $29. Wholesale, from $2.50 to $2 per ton.

Victoria, B. C.—Victoria-Phœnix Brewing Co.: The ice trade in this city is very small, owing to the cool winds which prevail during the summer. All the ice used is manufactured by us during the process of cooling the beer. Prices vary from 1c. per lb. for small quantities to ¼c. for large.

COLORADO.

Denver.—Republican, April 5: According to circulars now being issued by ice dealers in the city, the price of ice is to be advanced, the old schedule of rates in effect since 1891, excepting during the latter part of last year, being restored. The tickets issued to customers are all in lots of thirty, and hereafter 10-pound tickets will cost $2, instead of $1.50, the old price; 20-pound tickets will cost $3, as against $2.40; 25-pound tickets, $4.50, as against $3; 30-pound tickets, $4.50, as against $3.60; 35 pounds, $5.25, as against $4.20; 40 pounds, $6, as against $4.80; 45 pounds, $6.75, as against $4.50; 50 pounds, $7.50, as against $5.80. F. K. Sowers, president of the Colorado Ice and Cold Storage Co. says: "The new rate is merely a restoration. At the time the financial panic struck us last summer we were obliged, in conformity with other reductions, to reduce our prices and almost force our ice upon the public. It was either a question of do that or close down the factory altogether. Rather than suffer loss that way, as it would have been a most serious loss, we decided to reduce our rates. The experiment cost us $30,000."

CONNECTICUT.

Hartford.—Times, April 9: The Hartford and Spring Brook ice companies have published their schedule of the price of ice during the coming season, and the figures will be generally agreed to by the other dealers. The prices of last season are advanced, especially to small consumers, as will be seen by comparing the two schedules:

	Cost per week. 1893.	1894.
12 lbs. daily........	$ .50	.60
16 " "	.65	.75
20 " "	.80	.90
25 " "	1.00	1.10
50 " 3 times a week	.75	.75

	Per cwt. 1893.	1894.
100 lbs. and less than one block.........	$ .40	.40
By block, less than 100 lbs...........	.30	.30
500 lbs. and over...	.20	.25

The crop is about two-thirds of the usual harvest.

New Haven.—Hygeia Ice Co.: Our prices for manufactured ice are 15c. per cwt. to large markets; 20c. to smaller markets and saloons, and 40c. to cash family customers.

GEORGIA.

Augusta.—Augusta Ice Co.: Our prices are as follows: 12 lbs., 5c.; 25 lbs., 10c.; 50 lbs., 20c.; 100 lbs., 30c.; 200 lbs. to 600 lbs., 25c. per cwt.; 600 lbs. to 1,200 lbs., 20c. per cwt.; 1,200 lbs. to 1,500 lbs., 17½c. per cwt.; ice packed in sacks, single 100 lbs., 40c.; 200 lbs. to 600 lbs., 37½c. per cwt.; 600 to 1,200 lbs., 35c. per cwt.; 1,200 lbs to 2,000 lbs., 32½c. per cwt. Car load of 10 tons or more, $3 per ton. We will further state that we have put in a new 20-ton machine, making our present capacity forty-five tons daily. The prospect for the trade this season seems better than it was last year, because the prices agreed upon are somewhat better and there was considerable cutting in prices here last season.

Augusta.—Chronicle, March 20: The Augusta Ice Co. and the City Ice Co. will not consolidate, as rumored, but have agreed upon a new scale of prices and have promised each other not to cut the rates. The companies will not consolidate, but will be run separately and independent of each other, but their prices for ice will be exactly the same. The fixed prices now are not much higher than they were last year; in fact, the retail prices are the same.

ILLINOIS.

Dixon.—The Dixon Ice Co. will furnish ice this season for domestic uses at the same prices as last season.

Springfield.—Register, April 11: The raise in the price of ice from 25c. to 50c. per 100 lbs. to commission men, grocers, hotel and restaurant keepers, which took place on April 1, did not last long, and yesterday some dealers were offering ice at the old price, 25c.

INDIANA.

Columbus.—Ruddick Artificial Ice Co.: Ice retails at from 25c. to 50c. per cwt.

Indianapolis.—Journal, February 19: "In speaking about prices for ice the coming season, one of the oldest dealers said

yesterday that he thought the consumption of ice would not be as large as in the last two or three years, as unquestionably the consumers would be obliged to pay at least double what they did in 1893 for ice, when it was sold, for domestic uses, much lower than in any former year." *Sun*, March 15: "There is good promise for a lively war among the ice dealers," said a member of the largest concern in the city. "One large artificial ice plant is already in course of construction, and another new company has just been formed with the intention of putting up another, which will bring in at once two new competitors who must draw their trade from the field already covered by the present companies. This means that the older companies will try to hold their trade at any cost, and the new companies will fight even to the cutting of prices to get their share of patronage.

Shelbyville.—Republican, March 29: The Shelbyville Ice Mfg. Co., G. W. Neal, superintendent, after running at a loss for three years, have concluded to make the schedule of prices as follows for the season, to take effect April 1, 1894: Deliveries under 50 lbs. ice, 50c. per cwt.; 50 lbs. and upward, 40c. per cwt.; 100 lbs. and upward, 30c. per cwt.; 200 lbs. and upward, 25c. per cwt.; 500 lbs. and upward, 20c. per cwt.

IOWA.

Davenport.—Heidt & Lerch send rates for 1894: Families using 10 lbs. daily, $1.50 per month; 15 lbs., $1.75; 20 lbs., $2; offices, daily, Sunday excepted, $1.25; putting in refrigerator, 25 cts. extra per month. Families using from 20 to 100 lbs. at one delivery, 30c. per cwt.; put in refrigerator without charge. Parties using from 100 to 200 lbs. at one delivery, 25c. per cwt.; 200 to 500 lbs., 20c.; 500 to 1,000 lbs., 17½c.; 1,000 to 2,000 lbs., 15c.; 2,000 to 5,000 lbs., 12½c.; put in refrigerator without charge. At ice houses, $2 per ton. Our ice crop could have been better, but we got about 4,000 tons of channel ice from 8 to 10 inches thick, and as clear as glass. There is not one-half the ice there was in former years, and this fact gives the artificial ice company about one-half of the trade. The brewers and pork packers have their houses all filled.

Sioux City.—Journal, April 9: Knud Sunde says the price of ice the coming summer will be the same as last.

KENTUCKY.

Covington.—Champion Ice Co.: Our prices for ice delivered from wagons and at the house are as follows per cwt.: 5 to 10 tons, wagon, 20c., at the house, 17½c.; 1 to 5 tons, 25c., 20c.; 1,200 to 2,000 lbs., 30c., 20c.; 600 lbs. to 1,200 lbs., 35c., 30c., 100 to 600 lbs., 40c., 35c.; 50 lbs. to 100 lbs., 50c.; brewers for their own use. 20c., 17½c.; for icing cars, 30c.; dealers and peddlers who must sell at card rates, 17½c.; special rates for boat and car load lots. Retail best, 35 lbs. for 20c.; 25 lbs. for 15c.; 15 lbs. for 10c. and 6 lbs. for 5c.

MARYLAND.

Baltimore.—American, April 2: Officials of the ice companies have stated that so far as Baltimore is concerned, the supply of ice for the coming season is assured. Prices will be the same as the past year; 30c. per cwt. for stores and 40c. for families.

MASSACHUSETTS.

Abington.—Chas. F. Dudley reports as follows: Chas. F. Dudley has 3,000 tons of 12-inch ice cut, it being about one-third snow ice. Prices to families, 25c. per cwt.; to stores, 20c. per cwt., markets, 15c. per cwt.—*Brockton.*—Flagg & Bartlet, 20,000 tons of 9-inch ice cut, it being clear of snow. Prices, families, 25c. per cwt.; stores and hotels, 20c. per cwt.: market, 15c. per cwt.—*Rockland.*—Baker & Whiting, 3,500 tons of 12-inch ice cut, of very good quality. Prices, families, 25c.; stores, 20c.; markets, 15c. per cwt. —*Whitman.*—Wm. H. Dudley, 2,000 tons and E. E. Robbins, 2,000 tons of 12-inch ice cut this winter, about 4 inches of it being snow ice. Here we have a different report. The competition between the two dealers has been a long fight, and prices are extremely low. Families are supplied for 20c. per cwt.; stores, 15c. per cwt.; and markets, 12½c. per cwt. How long these prices will last is as yet unknown, but all dealers in this vicinity sincerely hope it will not last long, as it is unpleasant for us to sell at a fair price, when prices are being cut so much right under our very noses.

Boston.—Herald, April 9: It is a cheerful announcement that the price of ice in Boston will not be advanced beyond the figure of last summer this season, notwithstanding the action of the New York dealers in the article in putting up their prices ten cents per hundred pounds. The New England crop appears to have been far more abundant than that gathered on the Hudson.

Holyoke.—Springfield *Republican*, April 2: The ice dealers in the city have fixed on their prices for the coming season, and the rates will be about the same as last year. The price to families will be unchanged, and will be 35c. per cwt. The dealers held a meeting about March 15, and will all hold to the same schedule of prices, the rates to take effect to-day. The companies parties to the agreement are the Holyoke and South Hadley Falls Ice Co., the Highland Spring Ice Co., Woodlawn Spring Water Ice Co., Nelson Croteau, of Willimansett, and L. B. McNee. The supply of ice is good, and large enough to supply the demand of the season.

Worcester.—Telegram, April 1: One of the leading ice dealers of the city said yesterday: "We have as much ice on hand now as we had at this time last year; prices are the same, and there is at present nothing that will lead me to believe there will be a change. Local prices are, at present, 25c. per cwt. for families, and 15c. for markets. At present, you can depend upon it, there is no fear of a rise in the scale of prices. A month later there may be developments that will cause an increase. As for an ice famine, there is no fear of one occurring here this summer."

MICHIGAN.

Bay City.—Tribune, March 28: Ice has gone up from $1.50 per week for 25 lbs. daily, to $1.75 per week, and larger amounts in proportion. Besides this, all extra orders will be charged for. The wholesale price has been advanced from 8 and 9c. per cwt. to 10c. There will be practically two companies in Bay City this season, the Standard and Bay County, and they have fixed the price between them. The People's company, which was in competition with the other companies last year, it is said, will go out of business, and the Crystal company, of Essexville, will confine most of its business to that village.

Calumet.—News, March 23: The Portage Lake and Lake Superior Ice and Cold Storage Co. have fixed prices as follows: Families, delivered at the gate, 30c. per cwt.; washed and put in ice box, 40c. per cwt. Saloons—the price will be 25c. per cwt., with special rates to large consumers.

Grand Rapids.—Consumers' Ice Co.: Prices here are, 20 lbs. daily on walk, $1.50 per week; same, carried, $1.75; same, washed and put in box, $2.25; 4,000 lbs. and over per month in box, 15c. per 100; under 4,000 per month, 20c.; under 1,500 per month, 25c., with minimum charge as for family service, viz., 20 lbs. daily; 2,000 and over at one time, 10c. per cwt., with extra charge of 25c. per ton (minimum 50c.) for putting in box. The prices all subject to discount of 10 per cent for cash before the 10th of month following delivery.

Saginaw.—The Saginaw Ice and Coal Co. has fixed the following rates at which lake ice will be furnished during the coming season: 20 lbs. per day, $1.50 per month; 25 lbs., $1.75; 30 lbs., $2; 40 lbs., $2.50.

MISSOURI.

St. Joseph.—St. Joseph Artesian Ice and Cold Storage Co.: Prices for 1894 per cwt.: 10 lbs., $1 ($3 per month); 15 lbs., 90c. ($4 per month); 20 lbs., 80c. ($4.75 per month); 25 lbs., 70c. ($5.25 per month); 30 to 50 lbs., 60c.; 60 to 90 lbs., 55c.; 100 to 300 lbs., 50c.; 400 to 600 lbs., 40c.; 700 to 900 lbs., 35c.; 1,000 lbs. and over, 25c.; boarding houses and groceries, 40c.; saloons and soda fountains, 30c.; fruit stands, 35c.; butchers, 25c.; restaurants, 35c. From present indications the dealers in natural ice are determined to hold up prices, so we think the outlook is better than it was last year. To be candid, the people are becoming convinced that nothing can be purer than the manufactured ice.

NEBRASKA.

Omaha.—Lamoreaux Bros.: We here in Omaha have a special price on every ice box in town of any size. In that way we don't have to guess how much ice a man will take. Markets pay us all the way from $2.50 to $4.00 per ton. The average butcher pays $3; saloons pay 15@25c. per cwt., the average saloon paying the latter price; hotels are charged $2.50 @ $5.00; grocery stores, $3.00@ $6.00; drug stores the same; families using less than 50 lbs. at a time are charged 50c. per cwt.; those taking more than 50 lbs. pay 40c. per cwt. excepting such as have boxes holding 800 lbs., who pay 25c. for each cwt. Ice is delivered here in town in car lots to cold storage and fish men at $2 00 per ton. Some of the breweries get their ice for $1.50 per ton delivered, they using from 4,000 to 5,000 tons a year. Ice is sold for out-of-town points at from $1.25 to $1.75 per ton. The ice harvest the last winter here has been good, and all dealers have a full supply. Quality, while not quite as good as last year, is as good as the average. The outlook for business in our line is good and prices are being maintained fairly well.

Tecumseh.—Special to Omaha *Bee*, April 1: The ice dealers of this city are engaged in cutting prices for next summer's contracts. Arrangements can now be made to have ice delivered to your door in any quantity at 10c. per 100.

NEW JERSEY.

Newark.—The Newark Ice Dealers' Association has announced the following prices: To grocers and butchers off of wagons, 30c. per cwt., but ice can be obtained by this branch of consumers at the dock at 20c. per cwt. Families will be supplied at these rates: Fifteen lbs. three times per week, 40c.; 15 lbs. four times per week, 50c.; 15 lbs. daily, 70c.; 20 lbs. four times per week, 60c.; 20 lbs. daily, 90c.; 25 lbs. four times per week, 70c.; 25 lbs. daily, $1; 30 lbs. upward, per 100 lbs., 60c.; offices, 15 lbs. six times, 60c.; 10 pounds six times, 50c. Dealers say that these prices will probably remain in force all summer. The machine ice men have joined hands with the natural product dealers, so there is little possibility of a cut in rates.

Orange.—Orange Distilled Water Ice Co., per John O. Head, president: We have to report that our prices for the season of 1894, to go into effect April 1 next, were fixed on March 22, as follows: Independent dealers and wholesale, $3.50 per ton; bridge—trade, 25c. per cwt., or $5 per ton; bridge—family, 35c. per cwt., or $7 per ton; butchers, etc., delivered, 35c. per cwt., or $7 per ton. Greenwood lake has about 40,000 tons from last year, and 20,000 tons new ice, besides a small quantity on near-by lakes. Waterloo Ice Co. has about 15,000 tons. Hopatcong Ice Co. not over half a crop. The prospects are good for maintaining the above prices, as the supply of natural ice will not last longer than August 1, and is of poor quality. We need a good year to make up for our past competition and ice

wars created and continued since we started our company, four years ago. In our factory we are, we think, abreast of the times. We are putting in two entirely new and improved Holmes condensers, with coolers and reboilers. We also are adding a new boiler—making three—for our 50-ton plant. We have storage for 1,250 tons of ice, and have completed all our repairs for the season, and expect to start up and run night and day as soon as possible—within a week—and run until October 1, unless we break down. We are, we think, making the finest quality of ice, and our business is increasing continually. But prices have been too low to furnish any dividends as yet. We are, however, abundantly solvent, and our credit is the highest.

NEW YORK.

Albany.—Argus, March 11: The ice dealers of the city, excepting the Hudson Valley Ice Co., yesterday fixed the prices for the coming season. The following dealers were present: Schifferdecker Bros., Parker Hall, Gener & Pappalau, Wall Bros., of Greenbush, Wilpers Bros., Joseph Pappalau and R. B. Rock. It was decided to charge 40c. per week for 25 lbs. daily; over 100 lbs., 25c.; 25 lbs. four times a week for 25c. The latter rate will enable many poor people to indulge in the luxury, and that was the object in making it. The crop this year is not over two-thirds what is considered a fair harvest, and it is ice that will waste badly in the handling.

Brooklyn.—Citizen, April 6: The price of ice has been raised 10c. per cwt.

Buffalo.—Commercial, April 5: The three largest ice companies in the city, E. Webster & Son, Buffalo Ice Co. and Queen City Ice Co., have agreed upon the following prices: 20 lbs. daily, 60c. per week; 30 lbs. daily, 80c. per week; 40 lbs. daily, $1.05 per week; 50 lbs. daily, $1.25 per week. About April 1, Wm. Scott, of the Chautauqua Lake Ice Co., said to a newspaper reporter: "Our company proposes to do business in Buffalo. The reason is this: So much ice is now being manufactured at home, in Pittsburgh, that we have a larger supply of the natural product than we need. Having this surplus on hand and Buffalo being only 64 miles from our storehouses at Chautauqua lake, we see no reason why we cannot find a market for it in Buffalo." This ice will be sold through L. B. Banks & Co., of No. 219 Erie street, and T. J. Nunan, of No. 447 Seneca street, to whom the Chautauqua company will ship all the ice they want, and the prices already struck are guaranteed for the entire season. Banks & Co. have 150,000 tons to put on the market on their own account and Nunan has 17,000 tons.

Catskill—Mail, April 3: The Middletown Ice Co. announces the following rates from April 1 until further notice: Consumers of 1,000 lbs. per week, 15c. per cwt.; stores, etc., 20c. per cwt.; families, 30c. per cwt. These rates are the same as last year, with the exception that the rate for consumers of large quantities is 5c. higher.

New York.—Mail, March 28: There was a general meeting of all the retail ice dealers of this city at the Grand Opera House yesterday afternoon, to agree upon a uniform price for ice. There are about 700 retail dealers in the city, and all were represented, from the largest, the Knickerbocker Ice Co., down to the smallest. The crop this year is very poor in quality and quantity. New York, Brooklyn, Jersey City and their environs use every season 2,900,000 tons, and the ice country tributary to the city only yielded 2,400,000 tons this year. The remainder of the supply necessary will have to be procured from Maine. This and other considerations made it seem advisable to the dealers to protect themselves. They say that the retail price of ice for the last five years has been ruinous to them: Many dealers have failed. The following scale of prices was adopted, and will be adhered to by all dealers. It is only for the present time, however, and is subject to change without notice. It is an increase of ten cents per hundred pounds all around on the prices of last year: To families, 12 to 15 lbs., daily, 70c. per week; 18 to 20 lbs., daily, 80c. per week; 25 lbs., daily, and upward, 50c. per cwt.; to offices, 8 to 10 lbs., daily, 50c. per week; 12 to 15 lbs., daily, 60c. per week; 25 lbs. and upward, daily, 50c. per cwt. Last year the rate was 40c. per 100 lbs. to offices and families. Those included in what the ice men term the "heavy trade," such as saloon keepers, grocers, druggists, etc., will pay 30c. per 100 lbs. Last year they paid 20c. These prices are subject to change at any time. The meeting was only the starting point of a movement to form into a regular association which will govern the prices of ice and keep them uniform.

Oswego Falls.—Observer, March 30: The prospect is flattering for the holders of ice that they will get profitable prices. Several offers have been proposed that would yield a large per cent above the cost of harvesting. Some are sanguine that as high as $2 per ton will be paid for Neahtawanta ice at the houses. There is a shortage of ice reported in Syracuse, Rochester, Buffalo and other New York cities, and retail prices have been advanced 40 per cent in Syracuse.

Rochester.—Advertiser, April 5: The local ice dealers have sent to customers the scale of prices for this season. All the dealers seem to have adopted the same scale. The advance is figured at 10c. per cwt. to most grades of consumers. The grading is according to the amounts consumed and the number of deliveries required. The new scale of prices is as follows: Offices, 10 lbs., 40c. per week; families, 600 lbs., 15 lbs. each delivery, $3.60; 1,000 lbs, 25 lbs. each delivery, $5; 2,000 lbs., 50 lbs. each delivery, $8; 4,000 lbs., 100 lbs. each delivery, $12. The prices for families are for forty deliveries. Last year's prices were $3, $4, $6 and $10 in place of the above amounts. An officer of the Silver Lake Ice Co. said: "The ice cut this winter is of a poor quality to keep well; it is not as dense as usual. Besides, the season was so short that the quantity of ice harvested is smaller than the average, and if the coming summer is as warm as we generally experience, we shall have to purchase ice in order to supply our customers. We generally rely on Canada to furnish us in case our crop falls short, but advices from Ottawa state that they have barely enough to carry themselves through the season."

Syracuse.—Rochester *Times*, April 2: People who want ice in Syracuse this year will be forced to pay $1.20 per month for it, instead of the former price, $6 for the entire season, lasting six months. Dealers in the Saline City say that the crop in that vicinity is shy about 15,000 tons, and only by very close figuring will the amount gathered last until winter comes again.

OHIO.

Cincinnati.—Tribune, April 14: Prices will be about as follows: For 6 lbs., 5c.; for 15 lbs., 10c.; for 25 lbs., 15c.; and from 50 to 100 lbs., 50c. In large quantities the following rates, including delivery from the regular wagons, prevail: For 1,200 to 2,000 lbs., 30c. per cwt.; 600 to 1,200 lbs., 35c. and from 100 to 600 lbs., 40c. per cwt.

Ironton.—Crystal Ice Co.: Our prices for ice this year will be $4.50 per ton at works; 30c. per cwt. to butchers and saloons; less than 100-lb. lots, 50c. per cwt.

OREGON.

Albany.—Albany Ice Works, E. J. Lanning, lessee: Our prices for ice this season are as follows: Wholesale car load lots, $5 per ton; butchers' trade, $8 per ton; retail—saloons and hotels, $10 to $15; local trade, families, etc., $20. There has been no ice harvest in the Willamette valley this season, 22° above zero having been the coldest weather we have had. The prospects are fair for a good trade. Although times are pretty hard, people cannot well do without ice when once used to the luxury.

PENNSYLVANIA.

Chester.—Consumers' Ice Mfg. Co.: Price list for 1894: Hotels, ice cream factories, store keepers and butchers, per cwt., 25 to 100 lbs., 35c.; 100 to 1,000 lbs., 30c.; 1,000 to 2,000 lbs., 28c.; 2,000 to 4,000 lbs., 25c.; 4,000 to 10,000 lbs., 22½c. Dealers, at platform, $3.25. Retail to families, 5 lbs. daily, 35c. per week; 10 lbs., 50c.; 15 lbs., 65c.; 20 lbs., 80c.; 25 lbs. or more, 50c. per cwt.; collections weekly or monthly. The outlook is good. We are enlarging our plant, and will have an output of 70 tons per day. The *Advocate*, April 7, says: The Preston Lake Ice Co., this city, last year charged at the rate of 40c. per cwt.; this year the price for the same quantity is 50c.

Harrisburg.—Crystal Ice Co.: Following are the general prices of ice dealers: For families, offices, etc., 7 lbs., 5c., 35c. per week; 12 lbs., 7c. and 49c.; 20 lbs., 10c. and 70c.; 30 lbs., 13c. and 91c.; 40 lbs., 15c. and $1.05; 50 to 100 lbs., at 30c. per cwt.; over 100 lbs. at 25c.

Lebanon.—The Mt. Gretna, Keystone and Lauber Springs ice companies have agreed on the following prices per week, daily deliveries: 8 lbs., 35c.; 12 lbs., 50c.; 15 lbs., 60c.; 20 lbs., 70c.; 30 lbs., 95c.; 50 lbs., single delivery, 30c.; 100 lbs., single delivery, 50c.; private refrigerators, drug stores and undertakers, 50c. per cwt.; butchers, etc., 40c. per cwt.; sales per ton, $6. The rule was agreed upon that no refrigerators shall be filled or ice sold by contract.

Norristown.—Consumers' Ice Co.: No natural ice harvested this season. Prices as follows, per week, daily deliveries: 5 lbs., 35c.; 8 lbs., 42c.; 12 lbs., 50c.; 16 lbs., 60c.; 20 lbs., 70c.; 25 lbs., 80c.; 30 to 100 lbs., 40c. per cwt. No Sunday deliveries.

Philadelphia.—Consumers' Ice Mfg. Co.: The price of ice has changed very little and cannot be depended on.

Philadelphia.—Record, April 2: All the leading natural ice companies have sent out cards announcing an increase of 5c. per cwt. in the cost of ice to consumers. This is an increase of 14 per cent over last year's prices. The new scale of prices per week is: 7 lbs., daily, 35c.; 12 lbs., 49c.; 16 lbs., 63c.; 20 lbs., 70c. 25 lbs., 77c.; over 25 lbs., 40c. per cwt.; restaurants, etc., 30c. per cwt.; $4.00 per ton delivered; $3.50 per ton to dealers. Last summer's prices were: 8 lbs. daily, 35c. per week; 12 lbs., 45c.; 16 lbs., 55c.; 20 lbs., 63c.; 25 lbs., 70.; 40 lbs. each delivery, 15c., and 50 to 100 lbs., 35c. per cwt. Secretary C. Hunt, of the Knickerbocker Ice Co., when asked why the advance had been made, said: "We cut no ice from the Schuylkill river and scarcely any from the lakes of New Jersey. The amount cut in the mountain regions of Pennsylvania is less than usual. For this reason nearly all of our ice must be shipped from Maine. The men in Maine who store ice for sale to dealers will put their prices up because there will be a better demand than usual for Maine ice."

Pittsburgh.—Leader, April 4: The local dealers, at a meeting held a short time ago, decided to supply their customers at the same rates prevailing last year, in spite of the short crop. The ice concerns of the two cities are organized in what is known as the Ice Dealers' Exchange, and the rate agreed on will be uniform throughout the season unless something unexpected occurs as the warm weather approaches. The following scale of prices was agreed on: Butchers, saloon keepers, restaurants and others who use large quantities of ice and are classed as the "heavy"

trade will be supplied at 25c. per cwt., while offices and families will pay from 35c. to 40c. per cwt. There are from 75,000 to 100,000 tons of ice consumed in both cities during the season. With the supply of natural ice on hand and the artificial ice plants in operation this demand will be more than met, so there will be no danger of a scarcity in this locality.

Sewickley.—Alden F. Hays: Price list for ice: 10 lbs., 7 deliveries per week, 63c.; 15 lbs., 7 deliveries, 84c.; 20 lbs., 7 deliveries, $1; from 25 to 50 lbs., 60 cts. per cwt.; 50 lbs. or more, 50c. per cwt.; 600 lbs. or over a week, 45c. per cwt. I succeeded in putting up about 300 tons, about one-third of what I need; and my competitor harvested less than I. We will be obliged to bring our supply from northern points and depend on artificial ice mostly the coming season. I notice customers are coming in earlier than they did last year. This is on account of the warm weather during the first three weeks of March. My list of customers is just 50 per cent larger than this time last March. It is a good omen and makes the ice man's pulse beat more joyfully. The only other dealer here and myself intend using the last year's list, as above. For the past two seasons he and I have pulled together harmoniously in respect to a uniform card and have agreed to let well enough alone. I derive much benefit and pleasure in the reports you make through your valuable magazine, and hope the trade at large have unanimously subscribed to ICE AND REFRIGERATION.

Uniontown.—Hygeia Crystal Ice Co.: Our prices this year will be 35c. per 100 lbs. to hotels and butchers; 65c. to domestic trade, and $3.50 per ton in car load lots.

York.—York Ice and Refrigerating Co.: Our prices are as follows now, with a prospect of an increase in the middle of the season. To those who purchase in excess of 200 lbs., 40c. per cwt.; to those who purchase from 100 to 200 lbs., 50c., and to those who purchase less than 100 lbs. at one delivery, 60c. per cwt.

RHODE ISLAND.

Providence.—Telegram, April 16: The retail price list of Earl Carpenter & Son has been made public as follows: Families, per week, daily deliveries—12 lbs., 49c.: 15 lbs., 56c.; 18 lbs., 63c.; 22 lbs., 70c., 26 lbs., 77c.; 30 lbs., 84c. This price list will go into effect May 1. A comparison with last year's list shows that there will be a general advance of 14c. a week on any specified quantity. Their wholesale prices will be: For 50 lbs., 20c.; for 100 lbs., 30c.; for 500 lbs., $1.25; for 1,000 lbs., $2.25; for 2,000 lbs., $4. This is an increase of $1 a ton on last year's prices. The other companies will probably adopt the same schedule of prices. At the present time Earl Carpenter & Son are supplying their family trade with ice from Worcester, which is of better quality than that harvested hereabouts. The freight on this Worcester ice is $1 a ton, which is exactly the increase in this year's prices.

TEXAS.

Austin.—Lone Star Ice Co.: Ice is sold at 50c. per cwt. One-third of our output is now sold in season; but new ice factories in our neighborhood have materially reduced our sales.

Bastrop.—J. W. Kennedy: I sell ice at 75c. per cwt. to saloons and 1c. per lb. at retail.

Cuero.—South Texas Ice Co.: We are shipping ice delivered in car loads, at $5.50 per ton, and delivering it from wagon in town, at 75c. per cwt. We are too far south for natural ice, so there was none put up. The prospect for this summer's trade is good. We are running at present, as we have several cars to ship in a few days.

Houston.—Zilker & McGaw: Our price list is as follows per cwt.: 1,000 lbs. and over, 35c.; 500 lbs. to 1,000 lbs., 40c.; 100 lbs. to 500 lbs., 45c. Families, 25 lbs. to 100 lbs., 60c. per cwt.; less than 25 lbs., 75c. per cwt.; sacked ice, 60c. In regard to natural ice harvest, we have none; all our ice is manufactured.

San Marco.—Era, April 2: R. M. Pettit has his factory in operation. Prices are as follows: 100 lbs. and over, 60c. per cwt.; 15 lbs. and under 100 lbs., 80c.; 5 lbs. and under 25 lbs., 1c. per pound.

VIRGINIA.

Lynchburg.—Lynchburg Ice and Refrigerator Co.: We have to sell ice here at a low price in order to keep out competition of northern ice, which can be laid down here at $4 a ton. Our capacity is large enough not only to provide the city of Lynchburg with ice, but also the surrounding counties. Sales in the city not exceeding 15 to 20 tons in the hottest weather, it is sometimes difficult to sell the surplus at anything like remunerative prices.

Richmond.—The Transparent Ice Co.: I assure you as positive that the four leading companies here will ask the following rates and will not accept less, nor will they cut rates: Under 100 lbs., one delivery, 50c. per cwt.; 100 lbs. to 900, delivered any one day, 40c. per cwt.; 1,000 lbs., same, 30c.; 2,000 lbs., one delivery, 25c. per cwt.; car load lots, $4 per ton. There are a few unreliable firms here and also a few peddlers who sell for any price they can get; they are not as a rule patronized by good trade. The weather here has been all that could be asked for by ice dealers, especially by the artificial ice producers, no natural ice being harvested in this vicinity, and in fact very seldom has the thermometer had cheek enough to get down to 30° this past winter. The prospects for a good year's trade are very encouraging to the dealers, and, as you see, at a very reasonable price.

WASHINGTON.

Spokane.—Crystal Ice Co.: Our price list for 1894 is as follows: Two tons or more at one delivery, $6 per ton; 1 to 2 tons at one delivery, per ton, $8; 1,000 to 2,000 lbs. at one delivery, 50c. per cwt.; 100 to 1,000 lbs., 60c. Family trade—100 lbs. or more, one delivery, 60c. per cwt.; 50 to 100 lbs., 75c.; less than 50 lbs., $1; office or store piece, per month, $3. All the ice used in Spokane this season will come from Loon lake, the Spokane Ice Co., the Loon Lake Ice Co. and the Crystal Ice Co. all having houses there, the capacity of which is about 12,000 tons. These houses have all been filled this winter with good ice, from ten to twelve inches thick. The entire crop will be consumed in Spokane this season. There was very little ice harvested within 200 miles of Spokane this winter, except what was cut at Loon lake; the crop was a total failure all through the Palouse country, and as far south and east as Pendleton, Ore.

WEST VIRGINIA.

Wheeling.—Wheeling Ice and Cold Storage Co.: We enclose price list as follows: Wholesale price list from April 1: For 700 to 2,000 lbs. per week, 35c. per cwt.; 2,000 to 6,000 lbs. per week, 30c. per cwt.; 6,000 lbs. and over per week, 25c. per cwt. Retail price list to families and offices from April 1, 1894: 6 lbs., six deliveries, 35c.; seven deliveries, 40c. per week; 12 lbs., 50c. and 60c.; 18 lbs., 65 and 75c.; 25 lbs., 90c. and $1; over 25 lbs., 50c. per cwt. To restaurants, confectioners and druggists, 40c. per cwt. The above rates are for ice delivered to consumers from ice wagons, and will be guaranteed for one year from date to Wheeling and Benwood trade who desire to contract for manufactured ice. Special prices made to independent ice dealers furnishing the city trade; to large consumers and dealers outside of the city we will make special quotations for car load shipments. This is our first attempt at dealing direct with the consumer, having in the past sold our product to the natural ice dealers, who supplied the trade; but owing to the competition last season between the manufactured and natural ice, the price was forced down so low that the business was unprofitable to all parties, both the dealer and manufacturer being discontented. This being an off year, with no ice harvested last winter from the Ohio river, we concluded that it was a good time to try to recover lost ground by placing only a fair price on our product; but our attempt has created a howl from all sides, especially from the saloon keeper and the butcher, urged on by an old dealer in his endeavor to breed discontent among large and small customers, and to further his attempt of preventing the manufacturers who have invested their money from controlling their own business, in which he has been assisted by the newspapers who seem to take a special delight in sowing the seeds of discontent and prejudice against the trade, "in order to secure competition." In this manner the business has been ruined in more cities than ours. There was no natural ice stored along the Ohio river last winter, and but little held over from last season. We have recently completed a large storage room for packing our surplus stock made during the early spring time, hoping to have a large demand during the heated season. We refrigerate our storage room with brine circulation direct from our freezing tanks, and hope to be able to hold about 225,000 cubic feet of storage from our two 30-ton Blymyer machines, and make our full 60-ton capacity. We are more than doing it now, being able to produce sixty-three tons of ice, and run our cooling rooms this early in the season, but can't expect to do so much later on, when the thermometer goes up to 80° or 90°.

WISONSIN.

Milwaukee.—Sentinel, April 12: Milwaukee has nothing to fear in the way of high rates on ice, and the price will be 10c. per cwt., the same as it has been for three or four years. The price will vary from 10c. to 15c. per cwt. according to the amount of ice used. The ice crop of Milwaukee and neighboring waters has been a bountiful one. The crop last year was large also, and the old crop is still in use, one or two well filled ice houses being left. The cut by Milwaukee companies and breweries is estimated at 300,000 tons. Formerly it was larger, but the purchase of refrigerators has reduced the amount harvested by the brewers.

——The Sherman Ice Co.'s new plant is equipped with a 25-ton De La Vergne machine.

——The Consumers' Ice Co.'s remodeled plant at Mobile, Ala., has a new 25-ton De La Vergne machine.

——The De La Vergne company has sold a 1¼-ton refrigerating machine to Cornell University, Ithaca, N. Y.

——The A. Sander Packing Co., Cincinnati, have purchased a 50-ton (second order) De La Vergne refrigerating machine.

——The Pabst Brewing Co.'s new ice factory and bottling house at Guthrie, O. T., will have a 60-ton De La Vergne machine.

——The new 100-ton ice factory and bottling house of the W. J. Lemp Brewing Co. at Dallas, Tex., will have a 150-ton De La Vergne machine.

——The Chino Valley Beet Sugar Co., Chino, Cal., have bought a 65-ton De La Vergne refrigerating machine, to be used for water cooling.

——T. M. Sinclair & Co., pork packers, Cedar Rapids, Iowa, have completed the erection of a 100-ton De La Vergne machine (a second order).

——The Carnegie Steel Co. at Pittsburgh have bought an 8-ton De La Vergne machine with which they will cool the drinking water used in their large building in the city of Pittsburgh.

THE activity in building operations seems to continue, notwithstanding the approaching end of the constructive season for ice factories. Our list of new plants is not quite so lengthy as last month, but it is very satisfactory in view of the general condition of business. the record is as follows:

ALABAMA.

Anniston.--The Anniston Whisky Co. has in contemplation the erection of a small ice machine.

ARIZONA.

Clifton.—Haley & Hill have purchased an ice machine from the Vulcan Iron Works, San Francisco, which will be operated by water power.

ARKANSAS.

Van Buren.—The Van Buren ice factory, of the Border City Ice and Coal Co., will be enlarged this fall to a 15-ton plant.

CENTRAL AMERICA.

San Salvador.—Rafael Moran has purchased one of the Vulcan Iron Works' (San Francisco) "special" small machines for ice making--the third machine of this type in this neighborhood. This machine will be operated by water power.

FLORIDA.

Ybor City.—The Ybor City Ice Co. is reported as having plans prepared for a new ice plant and cold storage house.

Tarpon Springs.—The Florida West Coast Co. has purchased an 8-ton Kilbourn machine, built by J. K. Kilbourn, Philadelphia.

GEORGIA.

Cuthbert.—Work on the new ice factory plant began March 28.

HAWAIIAN ISLANDS.

Hilo.—Abner Doble Co. has purchased a 1-ton ice machine from the Vulcan Iron Works, San Francisco, of their special type of small machines. It will be run by water power.

ILLINOIS.

Chicago.—The Monarch Refrigerating Co. is erecting on the north side of Michigan street, east of Cass street, a large cold storage house which will cost about $75,000. The new building will be 90×100 feet in area, and seven stories high, giving a storage floor capacity of 472,000 square feet. The plant will be equipped with two 75-ton refrigerating machines, contracts for which were let to the Vilter Manufacturing Co., of Milwaukee, on April 24. Messrs. Westerlin & Campbell, Chicago, on the same day were given the contract for the ammonia condensers and for all the pipe work of the plant. The machinery, etc., will cost about $50,000. The building will be completed by June 1. The officers of the new company are Michael Espert, president; Samuel Parliament, vice-president; James H. Rolfe, secretary, and Fred Espert, treasurer.

Danville.—H. Brensford, of Anderson, Ind., contemplates erecting a 50-ton ice plant in this city.

Duquoin.—The Duquoin Ice and Cold Storage Co. has been incorporated by Geo. F. and W. E. Blakeslee, W. H. East and W. E. Kingsbury; capital $12,000. They will operate a Westinghouse, Church, Kerr & Co. machine.

Randall.—Work on the new ice factory plant began March 19.

INDIANA.

Columbus.—The Ruddick Artificial Ice Co. are adding a cold storage house of about 13,000 square feet at present, the plant being so arranged as to admit of future enlargement of this space by 7,000 square feet.

Indianapolis.—The Polar Artificial Ice Co. is doubling its capacity, which will be eighty tons of ice a day. The company is sinking a well to get pure water.

Indianapolis.--The new Artificial Ice and Cold Storage Co. have purchased a 25-ton Frick machine.

Lebanon.—The work of setting of the machinery at the new ice factory began March 26.

Marion.—The Marion Ice and Cold Storage Co. have contracted with the Sulzer-Vogt Machine Co., of Louisville, for a complete 20-ton ice making plant. It will be in operation by May 20.

Rushville.—C. B. Lore has made a contract with the Sulzer-Vogt Machine Co., Louisville, for a 5-ton ice making plant, to be in operation by May 20.

KANSAS.

Independence.—The Independence Ice Co. has been chartered to manufacture ice; capital, $10,000; directors, John Hebrauk, J. C. Truman, A. C. Hall, Wm. Dunkin and O. J. Moon.

KENTUCKY.

Harrodsburg.—An ice factory will be put up here.

Paducah.—The Paducah Ice Co. contemplate building a cold storage addition to that plant, but just when the work will begin has not been decided.

LOUISIANA.

New Orleans.—The Consumers' Ice Co. have contracted with the De La Vergne company to remodel and reconstruct that plant entire, enlarging the capacity to 200 tons of ice daily.

New Orleans.—The Crescent City Ice Co. has bought a 25-ton machine of the Columbus (Ga.) Iron Works Co. which will be put into a new plant in a different part of the city from the present premises.

MARYLAND.

Aberdeen.—The Harford Ice Co. has bought a 3-ton ice making plant built by the Vilter Mfg. Co., Milwaukee.

Baltimore.—The Arctic Skating Co. will probably select a site on North avenue, near St. Paul street, for its proposed artificial ice rink. A building, 60×256 feet, is to be erected, and work on it will commence shortly.

Hagerstown.—The Hagerstown Ice Co. have put in a new brine circulating system, the work having been done by the Frick Co., of Waynesboro, Pa.

Mt. Savage.—The Mt. Savage Co. has closed a contract with the Remington Machine Co., Wilmington, Del., for the erection of a combined ice making and refrigerating plant at this place.

MANITOBA, CANADA.

Winnipeg.—At the monthly meeting (April 11) of the "Jobbers' Union," the committee appointed to look into the question of a cold storage warehouse, reported "that there exists in this city at the present moment a demand for a cold storage warehouse, if erected of sufficient size and on the latest approved principles. They find that there is over one car load per day of freight being brought into Winnipeg that should be warehoused in a building of this description; that a very heavy loss is incurred at all seasons of the year for the lack of storage accommodation, where an even temperature can be maintained, and believe that the erection of such a building would be of great advantage and secure for Winnipeg an increased trade in all such produce as eggs, butter, cheese, meats, fruits and vegetables. Your committee beg to state that they believe a cold storage building, under good management, would prove a good investment for the owners."

MISSISSIPPI.

Biloxi.—Chas. McCormick is building a 25-ton ice factory, for which the De La Vergne company has furnished the machinery.

Holly Springs.—J. G. Leach contemplates erecting a 5-ton ice plant in connection with an electric light station.

Tupelo.—A. W. and John Kaye have leased the Tupelo ice factory, to which they have added a new boiler and other improvements.

MISSOURI.

De Soto.—Curtis & Walters are just finishing a new plant here for ice making.

St. Louis.—A small refrigerating machine will be put into the new Missouri Medical college, on which work is in progress. At our last advice the contract had not been let for the machine.

NEW JERSEY.

Camden.--Adolph Segal is erecting a 60-ton ice making plant, for which the De La Vergne company has supplied two 30-ton machines.

Clayton.—The erection of an ice factory is contemplated by the Moore Brothers' Glass Co.

Gloucester.—The Welstach Light Co. has purchased a small refrigerating and ice making machine of J. K. Kilbourn, 935 Drexel building, Philadelphia.

Morristown.—The artificial ice plant of Shelly Bros. has been enlarged to a capacity of 30 tons a day.

Paulsboro.—The Lincoln Park and Steamboat Co. will erect an ice manufacturing plant of two tons capacity, having bought a 10-ton refrigerating machine from the Case Refrigerating Machine Co. The remaining 8 tons capacity will be used to cool ice boxes and refrigerators in various parts of their pleasure park.

NEW YORK.

Albany.—It is reported that a syndicate has been examining the malt house owned by Story Brothers, located on Broadway and Cherry streets, with an eye to convert it into a cold storage warehouse. The building is four stories high and near to both rail and water.

New York City.—W. L. Herrmance's cold storage house is being equipped with two 50-ton refrigerating machines erected by Voss & Evans, of New York.

Ogdensburg.—Ogensburg Cold Storage Co., capital, $20,000, has been incorporated; directors, Chas. Nightingale, John M. Kellogg, Chas. A. Kellogg, of Ogdensburg, and others.

NORTH CAROLINA.

Charlotte.—The Standard Fuel and Ice Co. have completed the erection of a 25-ton Arctic machine, built by the Arctic Machine Manufacturing Co., of Cleveland.

OHIO.

Cincinnati.—The Frick Co., Waynesboro, Pa., put in a new steam distilling and water purifying apparatus for the Cincinnati Ice Manufacturing Co.

Cincinnati.—The Stone Lake Ice Co. are building a 70-ton ice making plant, the machinery having been furnished by the Frick Co., Waynesboro, Pa.

East Liverpool.—The Frick Co. has furnished a 15-ton ice plant to the East Liverpool Ice Co., now erecting a new plant.

Massillon.—The plant of the Artificial Ice Co. has been finished, and is now making 15 tons of ice daily with a Sulzer-Vogt machine.

PENNSYLVANIA.

Chambersburg.—The Frick Co., contractors, are pushing the work on the new ice factory, of which Geo. D. McElvaine is superintendent.

Johnstown.—Chas. Suppes has purchased of the Frick Co. a 70-ton ice machine.

Philadelphia.—Jeremiah J. Gallivan is erecting a 35-ton refrigerating machine, built by the Pennsylvania Iron Works Co.

Philadelphia.—The Pennsylvania Iron Works Co. have erected a 4-ton refrigerating machine for Newton & McDevitt in Green's hotel.

Washington.—The Washington Ice and Storage Co. has been organized, with Geo. T. Walker, president; W. E. Brown, secretary; W. L. Milne, treasurer, and Geo. W. Manifold, manager. The company will make ice and do a cold storage business, both for themselves and for dealers who wish to store goods with them. The building will be 50×75 feet, sheeted with iron, a portion of it to be three stories high. The water supply will be secured from artesian wells, of which the company expect to sink several. Work on these wells and on the building has begun. The contract for the necessary machinery has been let to the Frick Co., Waynesboro, Pa., and according to the terms of the contract the plant will be in operation early in June. The capacity of the plant is to be twenty tons per day, and it will cost about $30,000.

TENNESSEE.

Memphis.—The new Consumers' Ice Co. (capital of $50,000) is officered by R. C. Bruce, president; Capt. W. H. Darragh, secretary and manager; Col. R. B. Snowden, Mr. R. Brinkley Snowden, Mr. James Darragh and Messrs. Cannon, Childress, Stewart and others as stock holders. A lot on Beale street, near the Charleston railroad crossing, 90×200 feet in size, was bought. The rear touches the Memphis & Charleston railroad diagonally, giving a front of nearly 150 feet. The foundations have been laid for a large, substantial brick building. The machinery has been ordered from the Hercules Ice Machine Co., Aurora, Ill., and will cost some $30,000. It is not proposed to change the present prices of ice, but the new company hopes to get its share of the trade. The present output of ice in Memphis is not far from 120 tons per day, to which this company will make an addition of fifteen tons daily.

Pulaski.—The Pulaski Ice Co. is about to add cold storage to the business of that company.

TEXAS.

Fort Worth.—J. T. Burt, W. H. Little and E. P. Maddox have incorporated the Texas Ice and Refrigerating Co., with a capital stock of $25,000.

Galveston.—Col. C. B. Lee, proprietor of the Neptune ice factory, has just completed improvements on his plant at a cost of nearly $3,000, which have added to his business cold storage facilities. There are five large compartments, each divided into five rooms.

Harrisonburg.—H. C. Pankey has purchased a 7-ton ice plant from the Frick Co., Waynesboro, Pa.

VIRGINIA.

Portsmouth.—C. R. Robertson & Co. have lately completed an ice factory and cold storage plant, together with facilities for killing and packing meats.

Winchester.—Some person here, identified as "Box 64," wants information regarding ice manufacture and cold storage, with estimates on machinery.

WEST VIRGINIA.

Fairmont.—John A. Clark, B. L. Butcher, G. L. Carrell, Wm. S. Raymond and J. A. Spence, of Monongah, have incorporated the Fairmont Artificial Ice Co., with a capital stock of $50,000.

Harper's Ferry.—James McGraw is enlarging his beer bottling department, adding a cooling and ice making machine and a soda water manufacturing establishment.

Wheeling.—The organization of a $40,000 stock company is proposed to erect an ice plant. John Loomis, John Kemble and Phillip Maurer are interested.

Wheeling.—Louis Niebergall, butcher, etc., has just started up a 5-ton ice machine erected for him by the Frick Co., Waynesboro, Pa.

Wheeling.—The *Register* of April 8, says: "The new Arctic Ice and Storage Co. have about completed their cold storage room, and are now packing it with ice to guarantee them a full supply this summer during the heated season. The company contemplate adding a 100-ton ice machine, work on the buildings for which began April 1."

Wheeling.—A local paper says that "the committee of the Saloonkeepers' Association appointed to solicit stock for the new ice plant began work April 10. A gentleman familiar with the situation, and one of the largest ice consumers in the city, said to a *News* reporter to-day that pledges had already been made verbally for over $30,000 of the stock." Later advices, however, do not look promising for a new factory.

FIRE AND ACCIDENT RECORD.

——An ice house owned by Dennis Sullivan at Arcola, Ill., was burned March 31.

——An ice house belonging to A. Sheckelhoff at Fremont, Ohio, was burned March 29; cause, incendiary.

——An unsuccessful attempt was made April 12 to burn the plant of the Uvalde (Tex.) Water, Ice and Electric Co.

——Two ice houses at Bridgeton, N. J., owned by C. R. Coney, were burned March 26; loss, $2,000; no insurance.

——Peter Schwab's ice house in South Hamilton, Ohio, was burned April 15; loss, $4,000; no insurance; cause, incendiary.

——E. N. Hubbard's ice houses at Shaddle Hill, Middletown, Conn., were burned April 18; loss, $10,000; partial insurance; cause, locomotive spark.

——The ice houses at Kurts' dam, above Coatesville, Pa., belonging to an ice company in Wilmington, Del., were crushed by weight of snow April 1.

——An ice house at Milford, Mass., owned by S. W. Hayward and leased by H. W. Burrill, was burned March 29; loss, $1,200; insurance, $1,000; cause, incendiary.

——The ice factory at Grenada, Miss., was burned April 6. The factory had been undergoing a general overhauling, preparatory to starting in on the season's business, and during the day previous to the fire the workmen had "fired up" and started the engine. It is presumed that the fire originated in some way from this same "fire up." The whole plant is a total loss, about $15,000, and no insurance.

MINOR LEGAL NOTES.

——The Pure Ice and Cold Storage Co., of Springfield, Ill., has surrendered its charter, the business to be continued as heretofore by the owners, but not as an incorporated company.

——Judge Hollister at Cincinnati March 22 granted a petition for dissolution to the Corryville Ice Co. and appointed Herald C. Robson and Charles Steinman receivers, with orders to sell the estate. They gave a bond of $270,000.

——Some time ago the People's Ice Co., of Boston, was obliged to pay $17,600 to its employes for injuries to them caused by the fall of an ice house in course of erection. The People's company sued the Employers' Liability Assurance Co. to recover this amount, but the Supreme court of Massachusetts held that the insurance contract did not cover that risk. The schedule of risks as appended to the policy were: "All operations connected with the business of ice dealers; places at which employes to whom wages are paid are employed; at 240 Ruggles street, Boston, and elsewhere in the service of the employer." The court construes the policy to cover risks for injuries received in connection with the carrying on of the business, and not risks connected with the erection of new ice houses or stables for the enlargement or better accommodation of the business.

PURE ICE QUESTION.

——The city of St. Joseph will require all ice dealers to register their names with the board of health and certify to the origin of their supplies of ice offered for sale.

——Hugh Dunlevy, ice dealer at Grand Forks, N. D., was recently arrested for disposing of his stock of Red Lake river ice to Dennis Haggerty, of East Grand Forks, after receiving notice from the board of health to destroy the same. Other dealers have gone to Maple Lake, Minn., for their supplies to handle their Grand Forks trade.

OBITUARY.

——Homer A. Allen, of the Westfield Ice Co., died of pneumonia April 1, at Springfield, Mass.

——The annual meeting of the Jos. Dixon Crucible Co., Jersey City, N. J., was held April 16, and was largely attended, 7,215 votes out of a possible 7,345 being cast. The old board of managers was re-elected. In the organization of the board Mr. E. F. C. Young was elected president; John A. Walker, vice-president and treasurer; George E. Long, secretary. This company was founded by Joseph Dixon in 1827, and organized as a stock company in 1868. Graphite is one of the principal forms of carbon. It is not affected by heat or cold, acids or alkalies, and is therefore one of the most useful materials known to modern industry when rightly prepared.

TRADE NOTES.

——John Coulson has sold his ice business at Medford, Mass , to Shaw & Pray.

——Jas. S. Frye, North Parish, Mass., has sold his ice business to O. H. & C. T. Hill, of Boston.

——P. N. Ramsey, New York, has bought a 6-ton machine from the Buffalo Refrigerating Machine Co.

——Jos. Womochel has sold his ice business at Muscatine, Iowa, to John F. Rosenmund and Peter Elfers.

——The Montauk Ice Co. has contracted to supply the Brooklyn charities commission with ice at $2.93 per ton.

——The Hercules Ice Machine Co. has sold a 6-ton refrigerating machine to the New York Biscuit Co., Chicago.

——The plant of the Lehigh Valley Cold Storage Co., Bethlehem, Pa., has been completed and is open for business.

——The Hercules Ice Machine Co. has sold a 7½-ton ice machine to Messrs. Griffin & Underwood, Lawrence, Kan.

——The Sevill Hotel Co., New York, has put in a 6-ton refrigerating machine built by the Buffalo Refrigerating Machine Co.

——Henry Burkhardt, Dayton, Ohio, pork and beef packer and dealer, has contracted for the erection of a 40-ton Sulzer-Vogt machine.

——The Hercules Ice Machine Co. has sold a 10-ton ice making plant to Dunkin & Moon, Independence Ice Co., Independence, Kan.

——The Hercules Ice Machine Co. has shipped a 5-ton refrigerating machine to Hoefling, Kilgore & Dunning, butchers, San Antonio, Tex.

——Chas. Meyer, dairyman, at Cattaraugas, N. Y., has put into his dairy a 6-ton refrigerating machine built by the Buffalo Refrigerating Machine Co.

——At the annual election of Creston (Iowa) Ice Co., J. H. Duggan was elected president, John Hall, vice-president and J. E. Markel, secretary and treasurer.

——Dr. Moale, erecting the "Strafford" hotel at Baltimore, Md., has purchased a refrigerating machine from the Remington Machine Co., Wilmington, Del., to be used in that building.

——W. A. Slater, of Norwich, Conn., has bought a complete Kilbourn machine (J. K. Kilbourn, Philadelphia) for making 150 pounds of ice daily, which will be installed on his new 1,000-ton yacht *Eleanor.*

——The Columbus Iron Works Co. is overhauling the ice making plants of the Big Springs Ice Co., Chattanooga, Tenn., that of the Columbus Ice and Refrigerating Co. and that of the Pioneer Ice Co., Montgomery, Ala.

——J. K. Kilbourn, 935 Drexel building, Philadelphia, has sold two of his type of refrigerating machines to the International Navigation Co. Philadelphia, for use on their S. S. *St. Louis* and *St. Paul*, to be operated by electric motors, making twenty-four of these machines in use by this company in their ships.

——The following breweries have recently put in De La Vergne refrigerating machines: Iroquois Brewing Co., Buffalo, N. Y., 75-ton; McCormick Brewing Co., Boston (second order), 35-ton; Phil. Kling Brewing Co., Detroit, 75-ton; J. & M. Haffen, New York, 50-ton; John A. Lengel, Wilmington, Del., 25-ton; Jacob F. Stoll, Troy, N. Y., 25-ton; Frank Dick, Bucyrus, Ohio, 35-ton; Texas Brewing Co., Houston, 25-ton ice plant; Western Brewing Co., Belleville, Ill., 150-ton; Anheuser-Busch Brewing Association (fourteenth order), 50-ton; Schaefer-Meyer Brewing Co., Louisville, Ky. (second order), 75-ton; Union Brewing Co., Boston, two 50-ton; Carl Lang, Huntington, Ind., 18-ton; Malcolm Brewing Co., Brooklyn, N. Y. (second order), 50-ton; Bartholomay Brewing Co., Rochester, N. Y. (fourth order), 40-ton ice plant; Ziegele Brewing Co., Buffalo, N. Y., 50-ton; Lone Star Brewing Co., San Antonio, Tex., 20-ton ice plant.

——At the annual meeting, April 9, at Portland, Me., the following officers of the Clark & Chaplin Ice Co., were elected: Directors, Charles W. Morse, Jacob S. Winslow, Wesley M. Oler, E. D. Haley, C. B. Church, Eleazer W. Clark, James T. Morse, Mervin W. Clark, D. W. Clark; president, C. W. Morse; vice-president, M. W. Clark; secretary and treasurer, Eleazer W. Clark.

WANTED AND FOR SALE ADVERTISEMENTS.

[The charge for advertisements in this column is $2 each insertion for seventy words or less, and twenty-five cents for each additional fourteen words. No advertisements will be inserted unless accompanied by the necessary cash. Parties answering these advertisements must write to the addresses given, as the Publishers decline to furnish any information concerning them.]

Ice Factory for Sale.

Ice factory, with land, buildings and machinery, complete and in first-class order. Daily capacity, seven tons. Situated in Richmond, Ky. Sold to settle an estate. Good bargain. Address A. St. J. NEWBERRY, Trustee, 711 Perry-Payne Bldg., Cleveland, Ohio.

Wanted.

A first-class man to go to Kansas; take charge and superintend artificial Arctic ice machine plant of forty tons. Expenses paid. State salary expected. For reference give former places of employment. Address "M. & B.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

Situation Wanted.

A competent engineer and machinist, well posted in ice making and cold storage, wants a position in either ice plant or cold storage house, or as travelling salesman and constructing engineer with some good ice machine builder. Have had seven years' experience in superintentending the erection of ice plants; can give best of reference in regard to character and ability. Address "J. A.," care ICE AND REFRIGERATION, 177 La Salle st., Chicago.

(4*)

DIRECTORY OF

Ice Factories, Ice Dealers and Cold Storage Houses.

THE PICTET ICE WORKS,
Manufacturers of Artificial Ice from Filtered and Double Distilled Lake Erie Water.
Capacity, 30 tons per day.
20, 22 & 24 Center St., Cleveland, O.

THE WASHINGTON MARKET CO.
Central, accessible and close to business, with over 300,000 feet cold storage space.
Center Market: 7th and Pa. Ave., N. W.,
Washington, D. C.

THE KRUEGER HYGIENE ICE CO.
Ice frozen from Filtered and Distilled Water.
Capacity, 120 tons daily.
Storage capacity, 12,000 tons.
Newark, N. J.

NORTHWEST COLD STORAGE & ICE CO.
Wm. McGuire, Sec'y and Treas.
C. H. Prescott, Pres. J. C. Lewis, Vice-Pres.
Wm. McGuire, Mgr. Portland, Ore.

STANDARD ICE CO.
Daily capacity, 135 tons.
Office: Wall Street.
Factories: Atlanta, Iceville and West End.
Morris Benjamin, Mgr. Atlanta, Ga.

CONSUMERS PURE ICE CO.
Manufacturers of Pure Ice from Filtered and Double Distilled Water.
Capacity, 240 tons per day.
Thirty-fifth and Butler Sts., Chicago.

EXCELSIOR ICE & COLD STORAGE CO.
Ice capacity, 80 tons daily.
W. H. Howe, Prop. Nashville, Tenn.

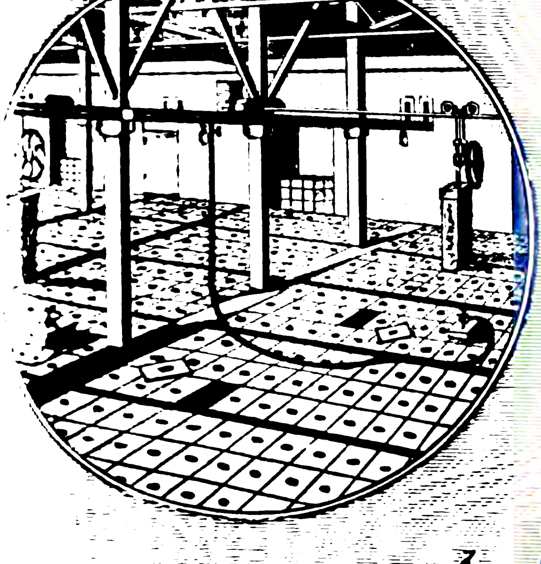
GEORGIA ICE CO.---N. O. ICE MFG. CO.
Capac'y, 40 tons daily. Capac'y, 80 tons daily.
J. M. Beath, Gen. Mgr. H. H. Blank, Supt. N. O.
Atlanta, Ga. New Orleans, La.

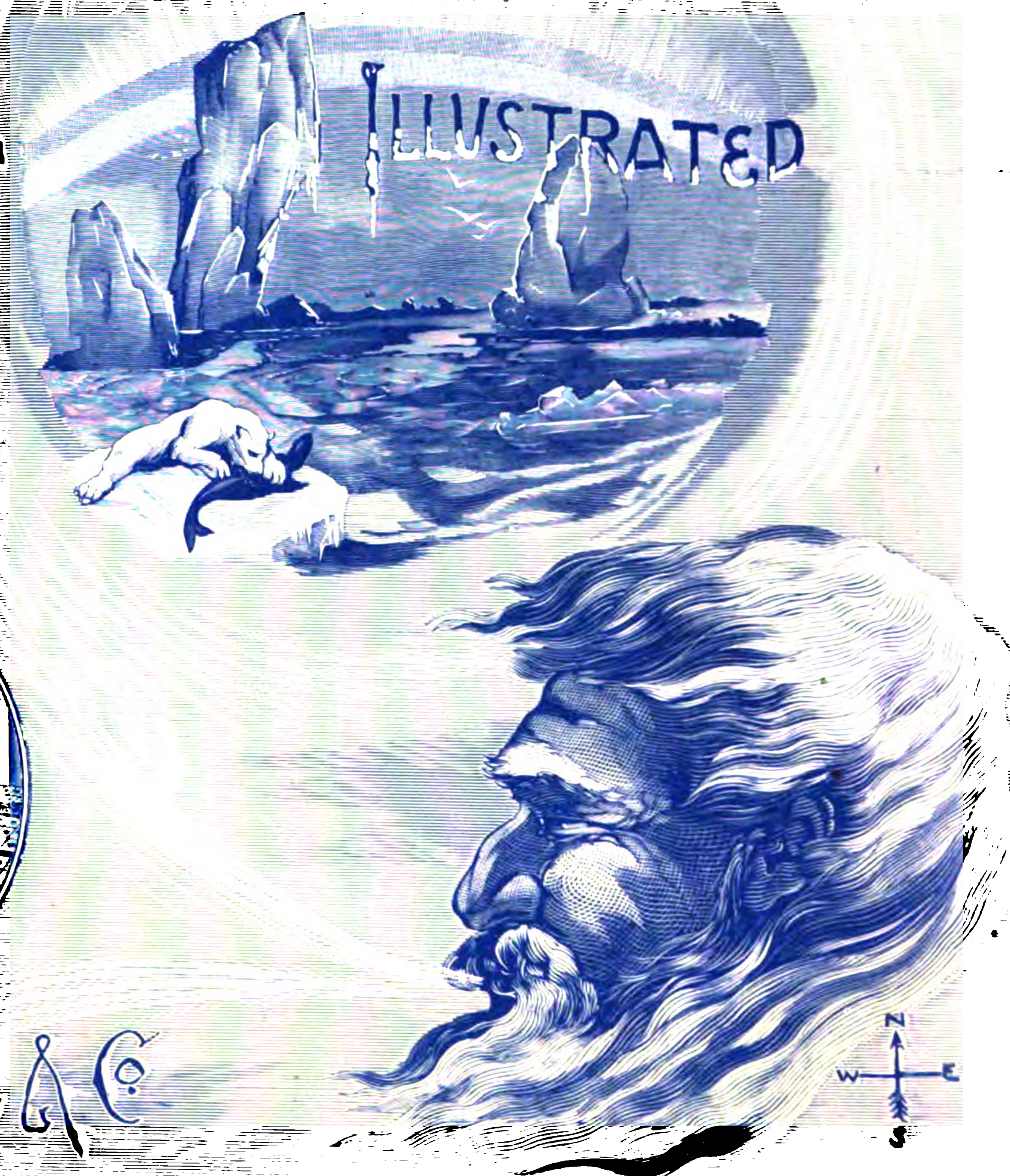
JAMES McCARTHY & SON,
Wholesale and Retail dealers in Ice,
Winter and Summer Shipments,
Lake Bras D'Or, Nova Scotia.

Vol. 6. No. 6.

June, 1894.

Ice and Refrigeration Illustrated





H. S. Rich & Co.
Publishers

Chicago & New York

T. B. WRIGHT & CO. MANUFACTURERS OF ESTABLISHED 1824

TRIPLE-BURNT GRANULATED CHARCOAL

FOR FILTERING AND ARTIFICIAL ICE MANUFACTURING

SAMPLES AND PRICES SENT ON APPLICATION.

PHILADELPHIA, Feb. 28, 1894.

To all Ice Dealers and whom it may concern:

We take pleasure in recommending the T. B. Wright & Co. Superfine Charcoal as the best in the market, and their cheaper brands compare favorably in price and result to those of other makes.

Very truly yours,

KNICKERBOCKER ICE CO.

OFFICE 117 Wood St., Philadelphia.

MILLS BERLIN, N. J.

HILPERT & CHANDLER ENGRAVERS BY ALL PROCESSES. REFER TO CUTS IN THIS PAPER FOR SPECIMENS OF WORK. 167 DEARBORN ST. CHICAGO.

MERRILL & WEHRLE CHARCOAL CO. W. M. MERRILL, President. F. J. WEHRLE, Secretary.

MANUFACTURERS OF PULVERIZED CHARCOAL

Granulated Charcoal for Ice Manufacturers a Specialty.

AT THE OLD ESTABLISHED PLACE 544, 546 & 548 West Twenty-Fifth St.

Bet. Tenth & Eleventh Aves. NEW YORK.

Standard Pipe Covering Co.

PRACTICAL PIPE AND BOILER COVERERS.

DEALERS IN MINERAL WOOL, ASBESTOS, PAPER AND ALL PLASTIC COVERINGS.

BRINE AND AMMONIA COVERING A SPECIALTY.

Office, 49 Frankfort St., Cleveland, Ohio.

THE ARMSTRONG TOOL HOLDER

For General Lathe and Planer Work.

Patented Feb. 28, 1893

A Practical Substitute for Forged Tools.

Saves forging, dressing and tempering, 70 per cent grinding, 90 per cent tool steel. Over 10,000 now in use by such firms as J. A. Fay & Egan Co., Frick Co., Morris Machine Works, W. P. Callahan & Co., Walburn-Swenson Co., Fitchburg Machine Works, Lodge & Shipley Machine Tool Co., and many other large concerns. Seven sizes, suitable for all kinds of work. Tools sent on trial to responsible parties. Manufactured only by ARMSTRONG BROS. TOOL CO., 76-78 Edgewood Ave., Chicago.

S. T. HOLMES

PATENTEE AND MANUFACTURER OF THE HOLMES

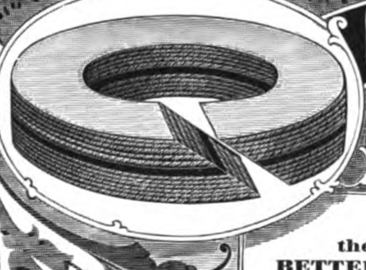
Exhaust Steam Filter

OIL SEPARATOR, CONDENSER AND HEATER COMBINED.

24 East Ninth Street, CINCINNATI, O.

OUR IMPROVED SUBMERGED CONDENSER.

CONTRACTS SOLICITED FOR COMPLETE ICE FACTORY OUTFITS, TRAVELING CRANES and HOISTS, AMMONIA PIPE and FITTINGS, BRINE PIPING, and FREEZING TANKS, ICE CANS, GENERAL ICE MACHINE REPAIRS.



CHESTERTON'S "EXPANSION" PACKING

The RUBBER, being in the CENTER instead of the outside, is PROTECTED from the OIL and gives BETTER EXPANSION, MORE DURABILITY, BETTER RESULTS. Everybody who has tried it says so. As this costs you no more than the old-fashioned kind you are using, WON'T YOU TRY ONE LOT of this and SEE if THIS IS NOT SO?

PRICE, $1.20 PER POUND.

MANUFACTURED BY A.W. CHESTERTON & CO.

49 INDIA ST. BOSTON. MASS.

(5)

DUNLEVY SHEET IRON WORKS

GALVANIZED IRON . . . . **ICE CANS** And all Sheet Iron Tank Work for ICE FACTORIES

WRITE FOR ESTIMATES. 515 North Levee, ST. LOUIS.

GALVANIZED STEEL **ICE CANS** IN CAPACITIES FROM 5 TO 2,000 LBS. EACH

LARGEST MANUFACTURERS OF

ICE CANS IN THE WORLD

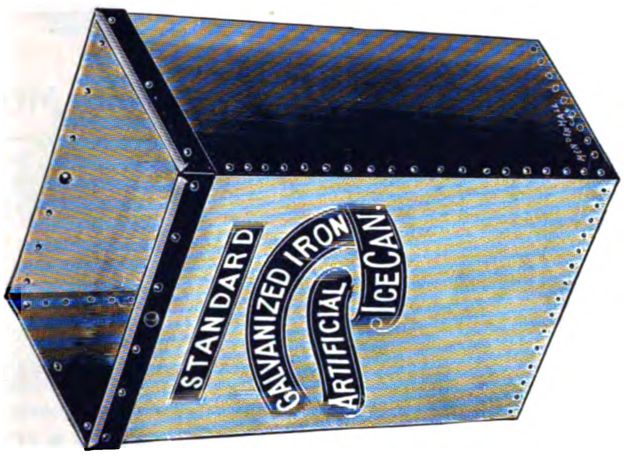
OVER 95,000 OF OUR CANS BEING USED IN 32 STATES TERRITORIES AND FOREIGN COUNTRIES.

SOLE MANUFACTURERS OF THE

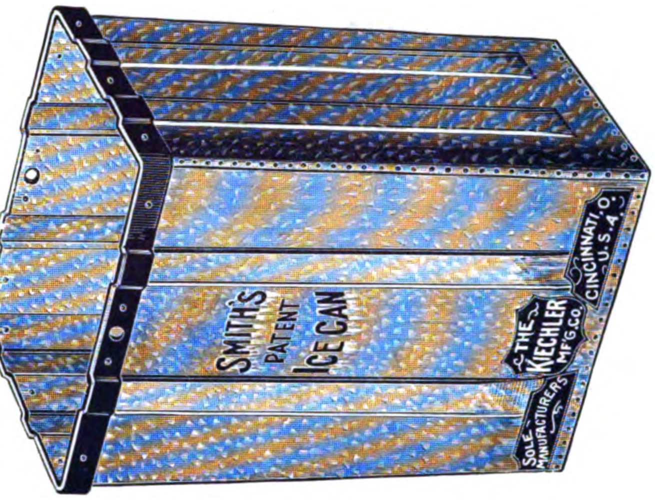
"SMITH PATENT RIBBED ICE CAN"

INFORMATION PERTAINING TO THE SUPERIORITY OF THIS CAN OVER ALL OTHERS, ALSO PRICES, GIVEN UPON APPLICATION.

"OLD STYLE"



"NEW STYLE"



"OUR" CAPACITY 300 PER DAY, FINISHED.

WRITE US FOR PRICES.

THE KIECHLER MANUFACTURING CO.

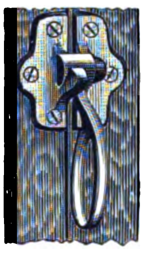
"POWER" SHEET METAL WORKS. CINCINNATI, O., U. S. A.

D. F. KENLY & Co.

ICE MACHINE AND BREWERS' WORK A SPECIALTY.

GALVANIZERS

WORK PROMPTLY EXECUTED
188 & 190 NORTH UNION ST. CHICAGO.



P. J. CONROY & CO.

75th St. and Island Road, PHILADELPHIA.

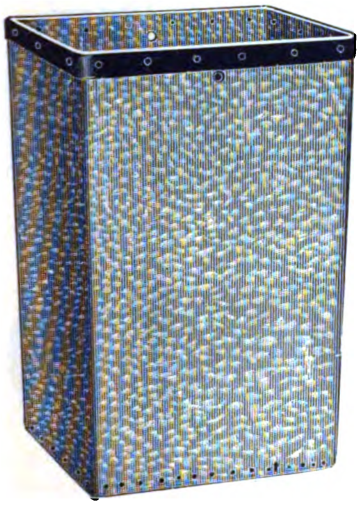
MANUFACTURERS OF THE

CONROY

Refrigerator Door Fasteners

Patented December 5, 1885.

Acknowledged by the largest Refrigerator Manufacturers to be the best in the market, Made to fit all doors.



ICE CANS...

GALVANIZED STEEL ICE CANS

OF EVERY DESCRIPTION
AND ALL OTHER WORK OF

Galvanized Iron in connection with Ice Manufacturing.

ALSO MANUFACTURERS OF

Conductor Pipe and Eave Troughs, Skylights, Cornices, Etc.

MARLIN & CO. (Inc.)

206 Robinson St., ALLEGHENY, PA.

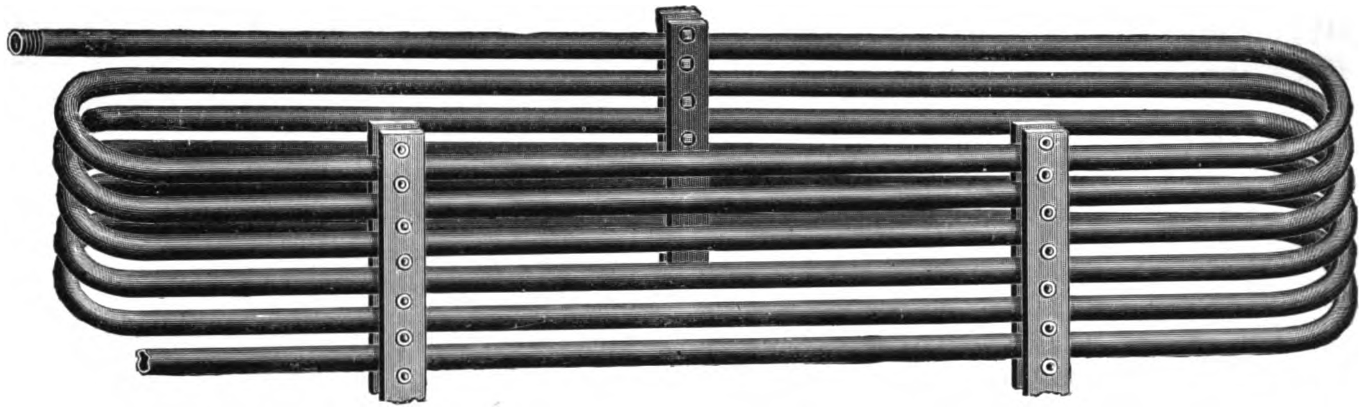
FARRELL & REMPE,

799, 801, 803 & 805 Ogden Avenue, corner Campbell Avenue, Chicago, Ill.

MANUFACTURERS OF

WROUGHT IRON COILS FOR ICE AND REFRIGERATING MACHINES.

PIPE · COILS · MADE · BY · ELECTRICITY

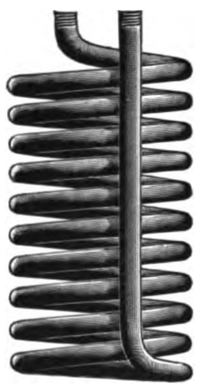


All Ammonia Coils made of the very finest quality of Pipe (in any desired continuous length) and Tested to 400 lbs. Air Pressure.
Coils of all Descriptions for Heaters, Soap Makers, Blast Furnaces, Etc.

PIPE BENDING OF ALL KINDS A SPECIALTY.

PRICES FURNISHED ON APPLICATION.

The Whitlock Coil Pipe Company

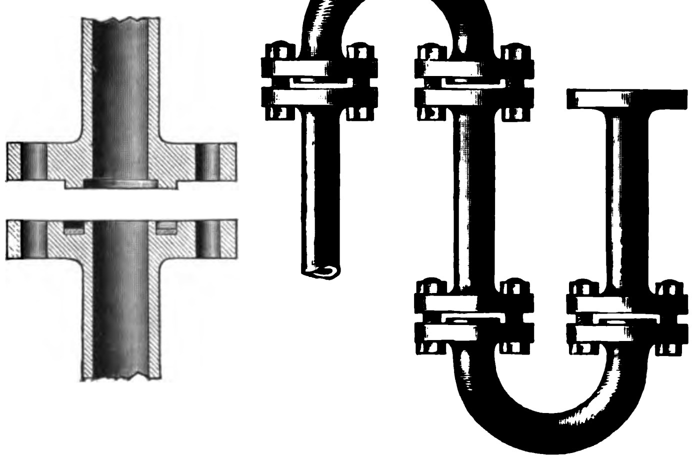


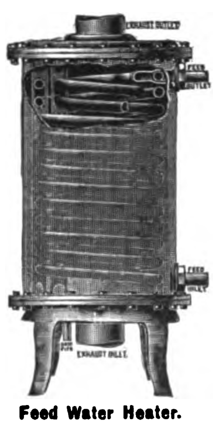
SEND FOR CATALOGUE AND PRICE LIST OF COIL WORK.

THE AMERICAN ANHYDROUS AMMONIA FITTINGS

The only reliable fitting for Anhydrous Ammonia, Brine, etc., now in the market. These flanges are made of steel and are welded solidly to pipe which does away with all threaded joints to leak, making the most reliable and durable fitting now on the market. We can furnish pipe fitted with our improved fittings of any desired length with return bends for same, all got out to measurement to fit any size refrigerating or cold storage plant, on short notice.

(PATENT APPLIED FOR.)





Feed Water Heater.

Coils of Every Description Made to Order

Of Copper, Brass, Iron and Steel correctly to sketch with our ***Hydraulic Bending Machinery,*** which we defy the world to equal.

NO FLATTENING IN BENDING. NO BURNING OF THE PIPE IN COILING.

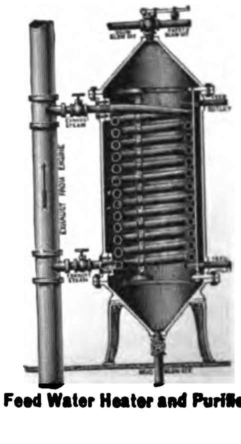
ALL WORK GUARANTEED IN EVERY PARTICULAR.

ALSO MANUFACTURERS

THE AMERICAN FEED WATER HEATERS

FOR ALL DUTIES.

ELMWOOD, CONN., U. S. A.

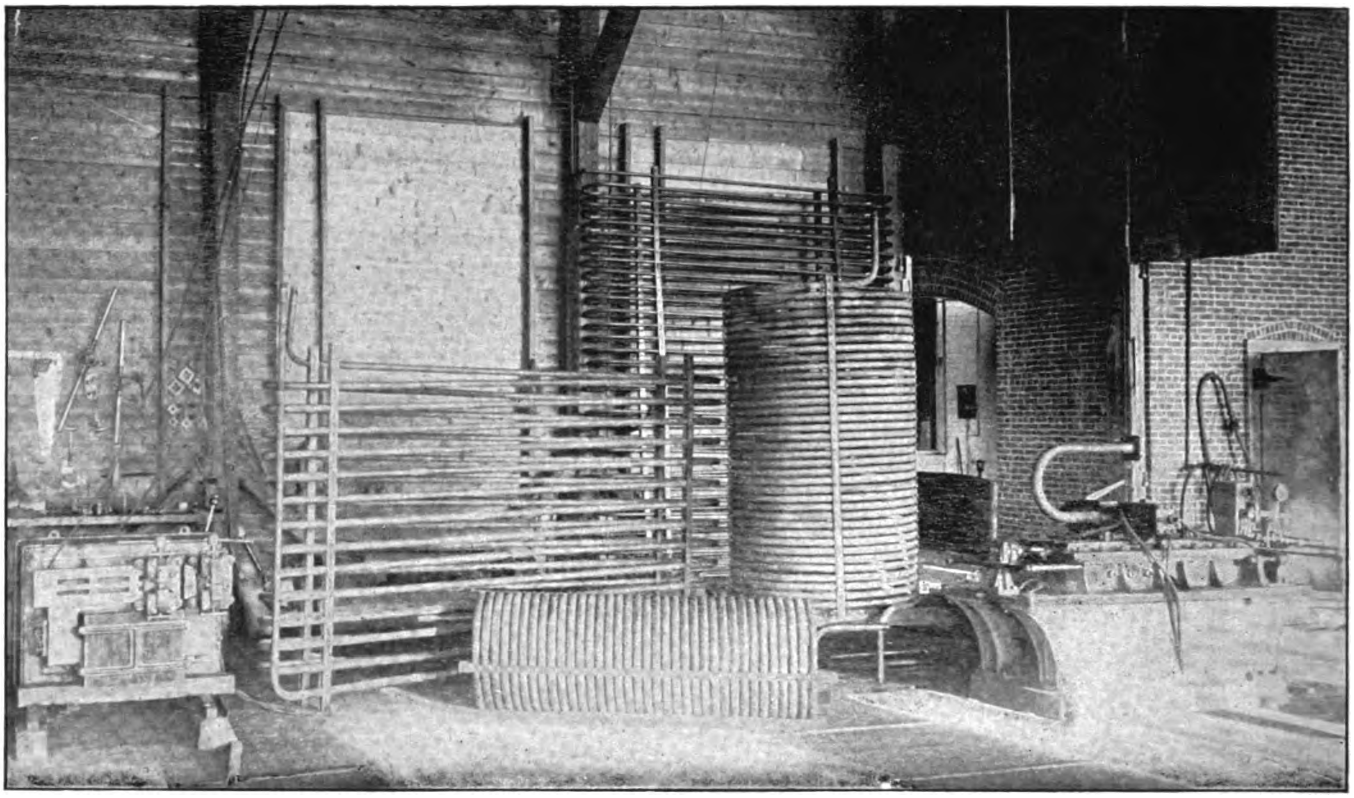


Feed Water Heater and Purifier.

Electric Pipe Bending Company

OF HARRISON, NEW JERSEY.

USING THE THOMSON ELECTRIC WELDING & HEATING PROCESSES.



VIEW OF SECTION OF COILING ROOM.

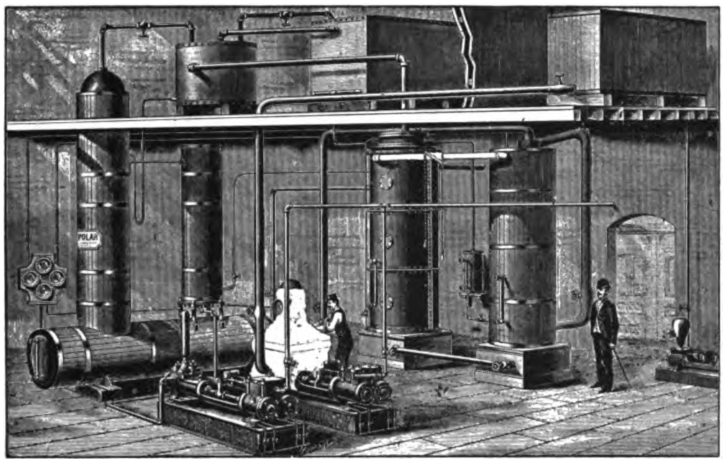
SPIRAL COILS, ZIG-ZAGS, OVALS and IRREGULAR SHAPES

OF ANY SIZE AND LENGTH.

No Injury from Overheating. Welds and Bends as Sound as the rest of the Pipe.

All Work Promptly Executed and Fully Guaranteed.

PRICES AND DETAILS FURNISHED ON APPLICATION.

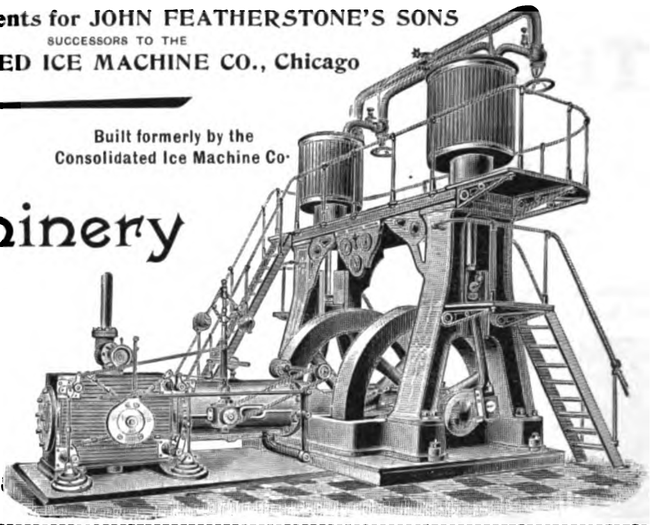


KREISS & STUPP

Sole Sales Agents for JOHN FEATHERSTONE'S SONS
SUCCESSORS TO THE
CONSOLIDATED ICE MACHINE CO., Chicago

AND DEALERS IN

Refrigerating and Ice Making Machinery



Built formerly by the
Consolidated Ice Machine Co.

ALSO CONSULTING ENGINEERS AND CONTRACTORS FOR

COLD STORAGE WAREHOUSES, PACKING HOUSES, BREWERIES, ICE PLANTS AND REFRIGERATING PLANTS OF EVERY DESCRIPTION

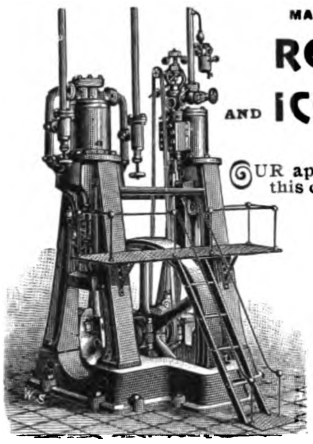
REPAIRS, IMPROVEMENTS AND CHANGES IN EXISTING PLANTS A SPECIALTY.

All Fittings for the Consolidated Ice Machine constantly in stock. Plans, Estimates and Catalogues furnished on application.

Reading, Pa.

AMERICAN ICE MACHINE CO.

J. F. MAYNARD, President.
G. A. WEISS, Vice-President.
T. J. CONNOR, Sec'y and Treas.



MANUFACTURERS OF

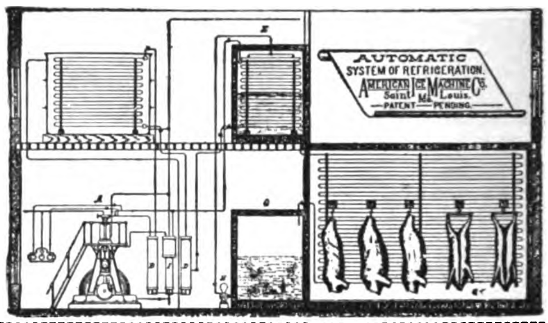
REFRIGERATING AND ICE MAKING MACHINES

OUR apparatus embodies the latest and best improvements in this class of machinery, and is durable and economical in operation. We are the only manufacturers of Refrigerating Apparatus that will produce and maintain a low and even temperature throughout the day and night, and needing no attention or power whatever during the night. The accompanying cut shows our Automatic Refrigerating System. Machines of one to one hundred tons capacity. Estimates and descriptive circulars cheerfully furnished.

OFFICE AND SHOPS,

320 and 322 SOUTH THIRD ST. **ST. LOUIS, MO.**

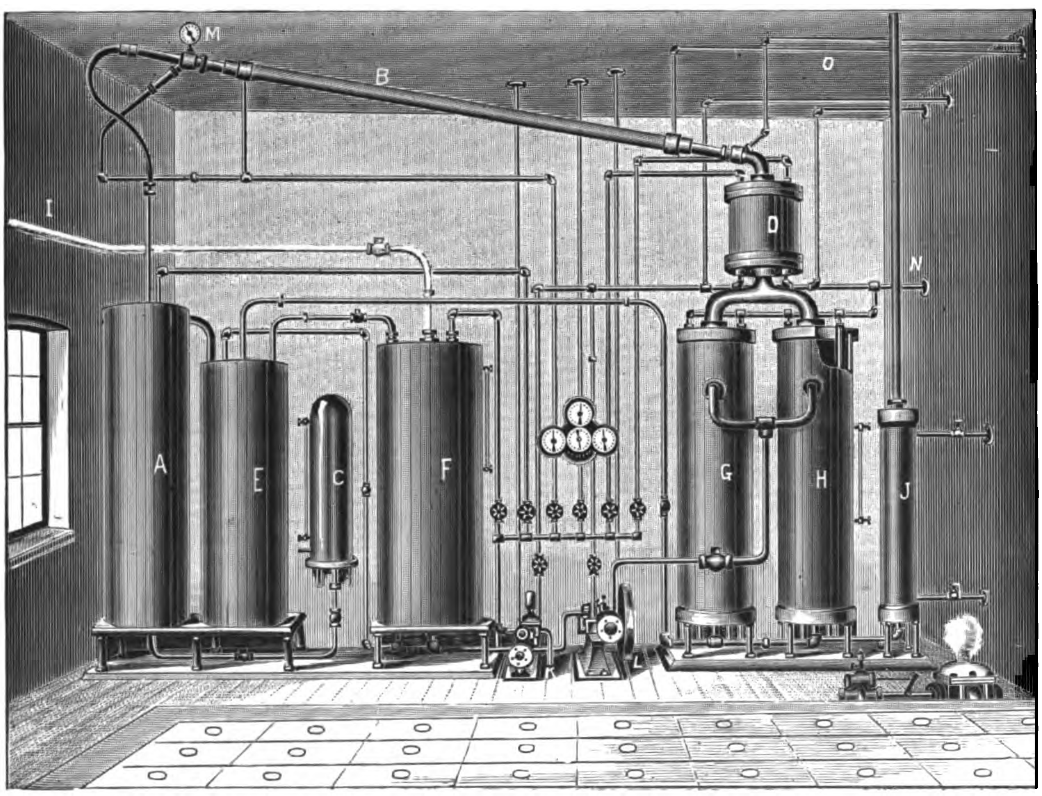
FOR ICE MANUFACTURERS, BREWERS, BUTCHERS, PACKERS, DAIRIES, ETC.



THE BURNS MANUFACTURING CO.

BUILDERS OF

IMPROVED ABSORPTION Ice and Refrigerating Machines



FOR ICE MAKING,
COLD STORAGE,
PACKING HOUSES,
CREAMERIES
AND BREWERIES.

Constructed on scientific principles, giving greatest possible results at minimum cost. Reliable, economical, easily handled and well constructed.

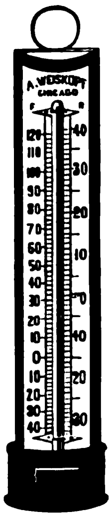
EVERY MACHINE GUARANTEED.

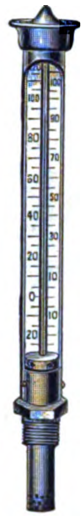
CORRESPONDENCE SOLICITED.

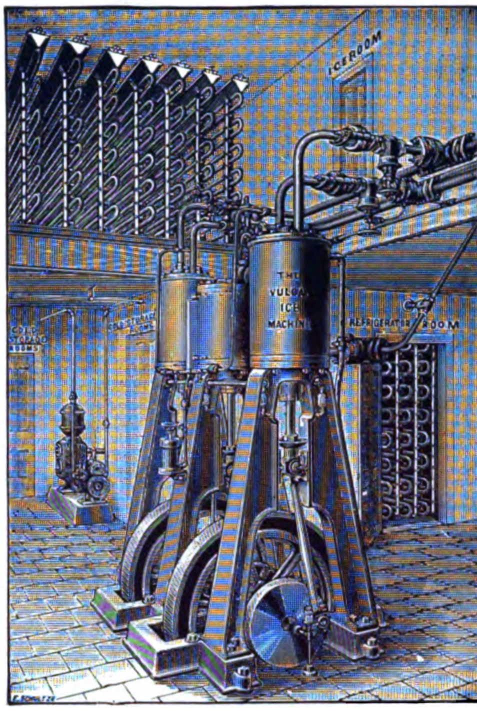
OFFICE:

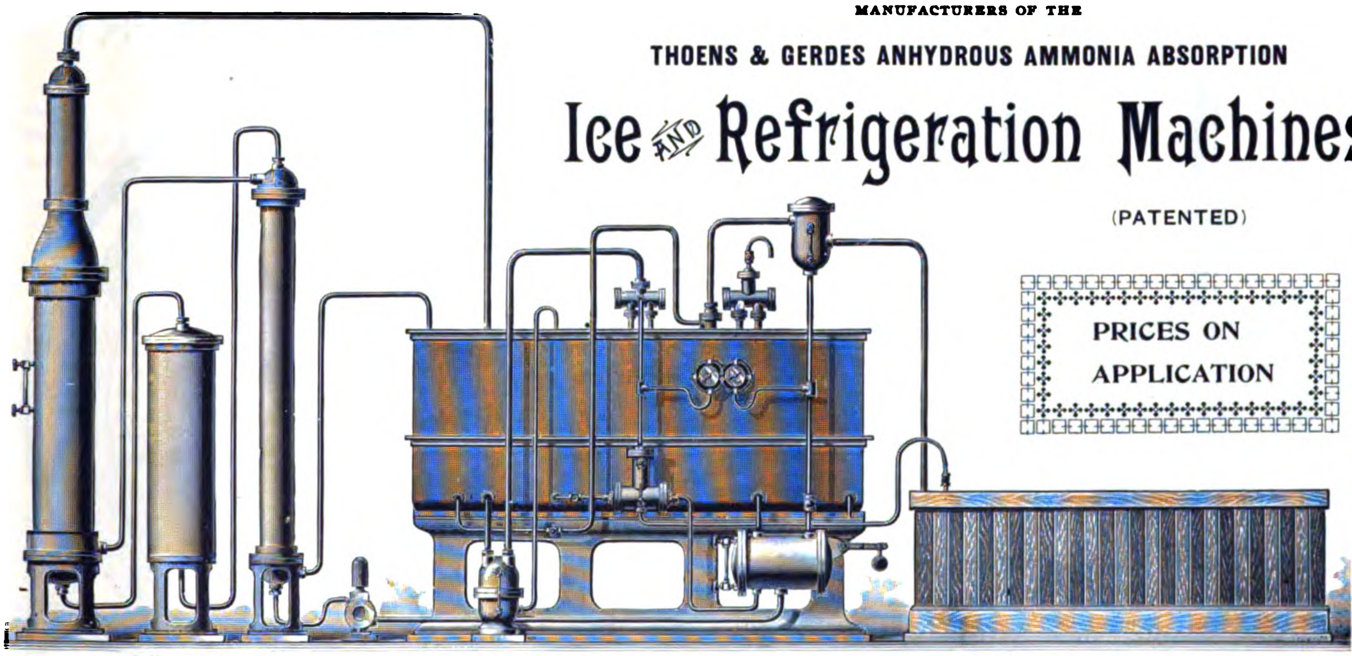
827 Equitable Building,

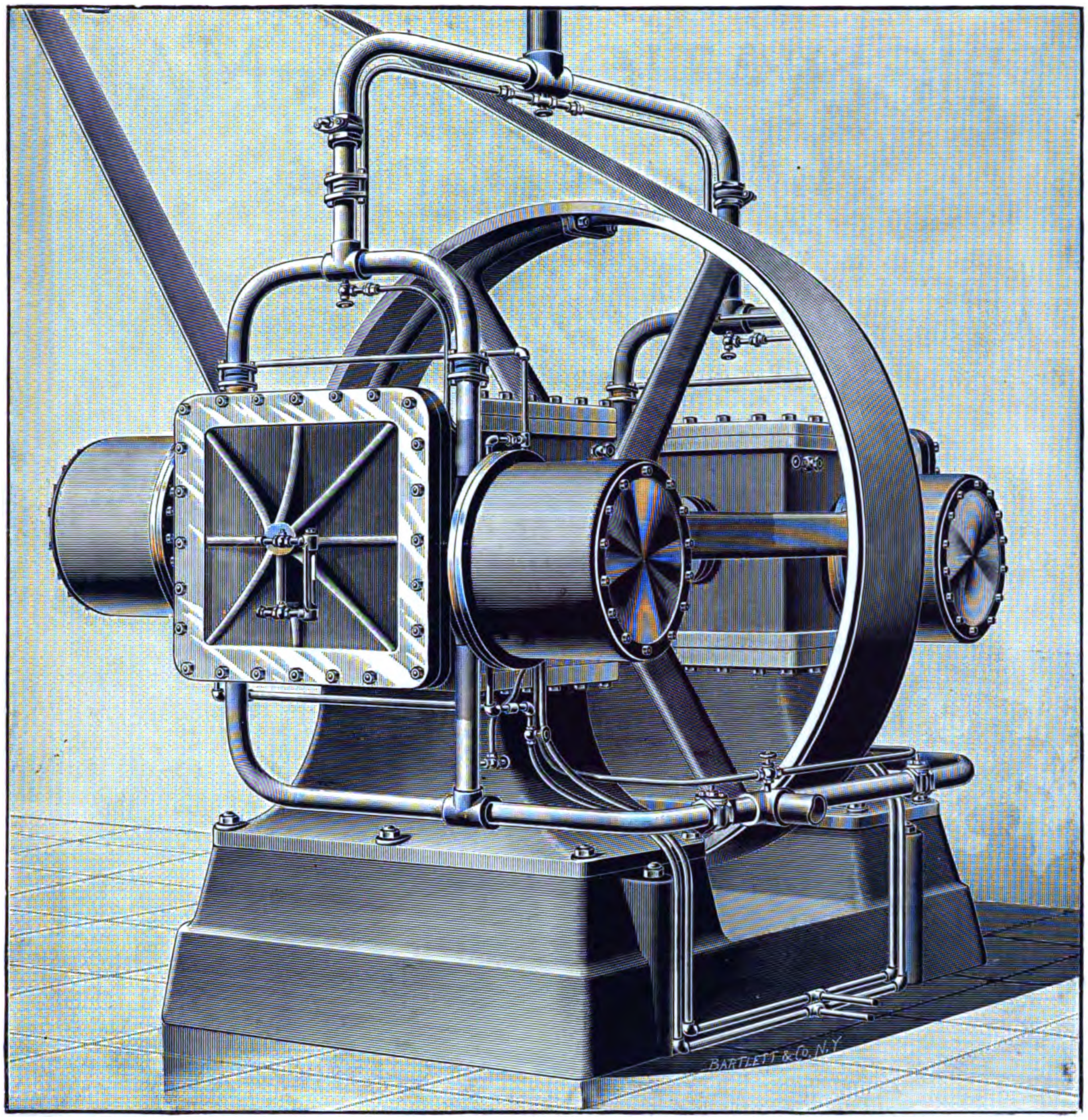
ATLANTA, GA.

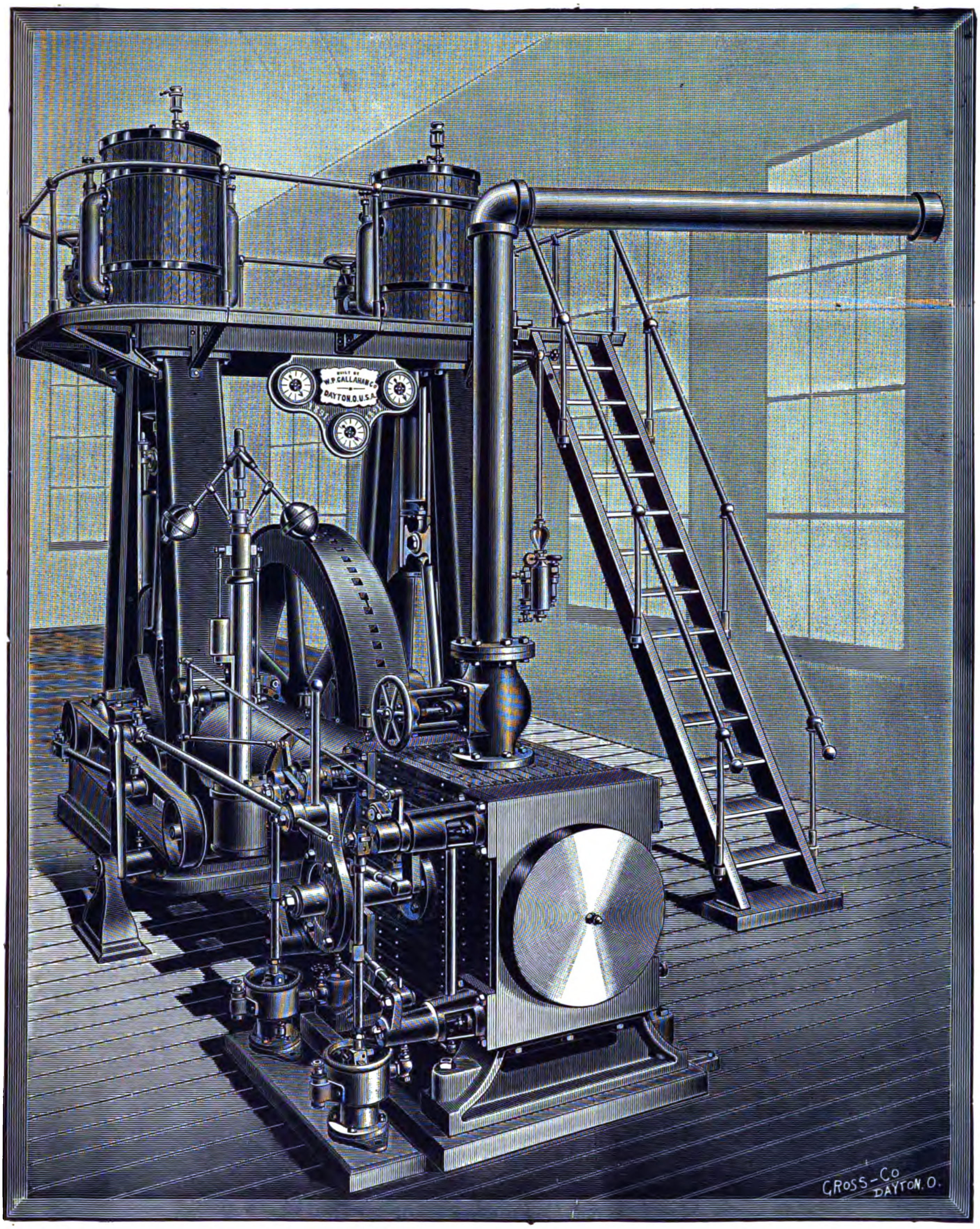









BARTLETT & Co. N.Y.


GROSS-CO
DAYTON, O.

COLUMBUS IRON WORKS

SUCCESSORS TO
H. D. STRATTON & CO.

Established 1853.
Incorporated 1856.

W. R. BROWN, President.
W. COOK, Superintendent.

Machines from 5 to 33 tons capacity per 24 hours, or larger if desired.

103 Machines Built

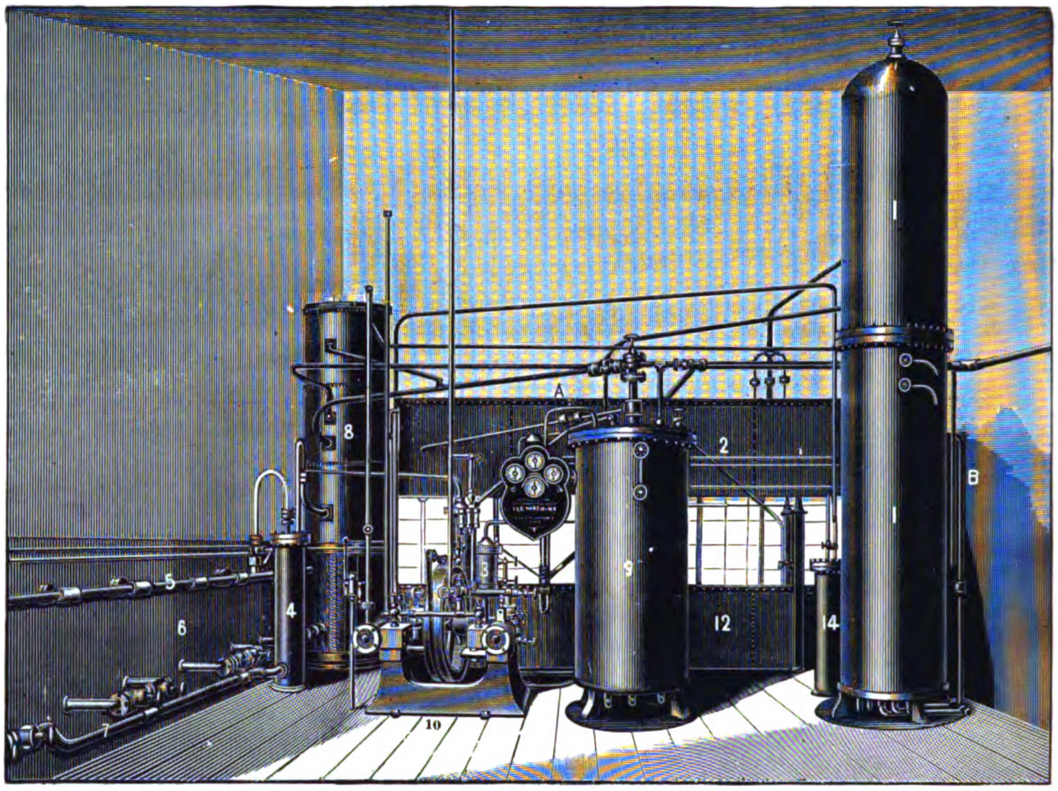
AND ALL IN SUCCESSFUL OPERATION.

More Ice Making Machines sold in the South than by any other establishment.

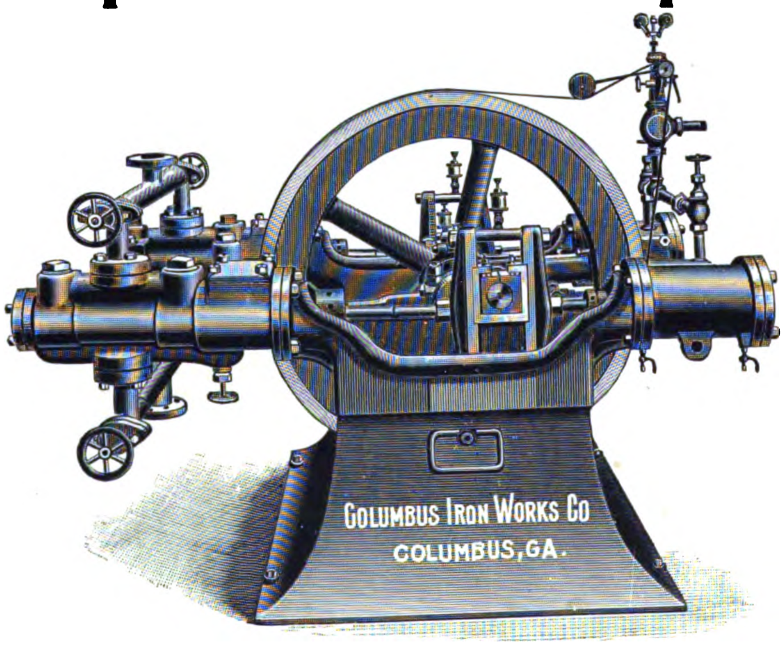
No expensive building required. No pressure on machine when stopped.

Send for price list and illustrated circular with location of machines.

This establishment was the first to turn out a perfect and complete Ice Machine, and has been in the business 21 years, constantly manufacturing and improving, and are prepared to furnish the most reliable and economical machine in the market.



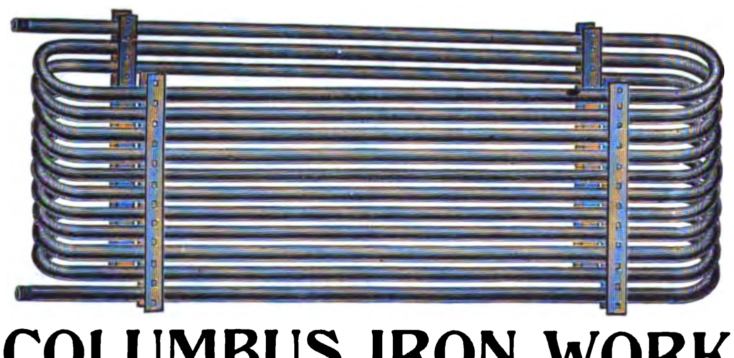
Improved Absorption Ice Machine



THE Pumps illustrated on this page are made especially for ammonia; are well and substantially built of the best material to be had, and are easy to get at for repairs, etc. They can be run duplex by running slow, or separate by being run at an ordinary speed, thus giving two distinct pumps of the proper capacity. The change from the one to the other can be made in less than fifteen minutes. They are thoroughly tested and guaranteed.

WRITE FOR PRICES

COILS



We have every facility for making the very best of Coils, using Electric Welding Machines that will enable us to produce coils of any length required, ranging in sizes from ¾ to 6 inches. Round coils made from 6 inches to 6 feet in diameter, and oval coils to 20 feet in length. We have had years of experience in making coils and can guarantee the best work.

COLUMBUS IRON WORKS Co COLUMBUS, GA.

The De La Vergne Refrigerating Machine Company

MANUFACTURERS OF

OFFICE AND WORKS:
Foot of East 138th Street,
(PORT MORRIS)
...NEW YORK...

REFRIGERATING AND ICE MACHINES

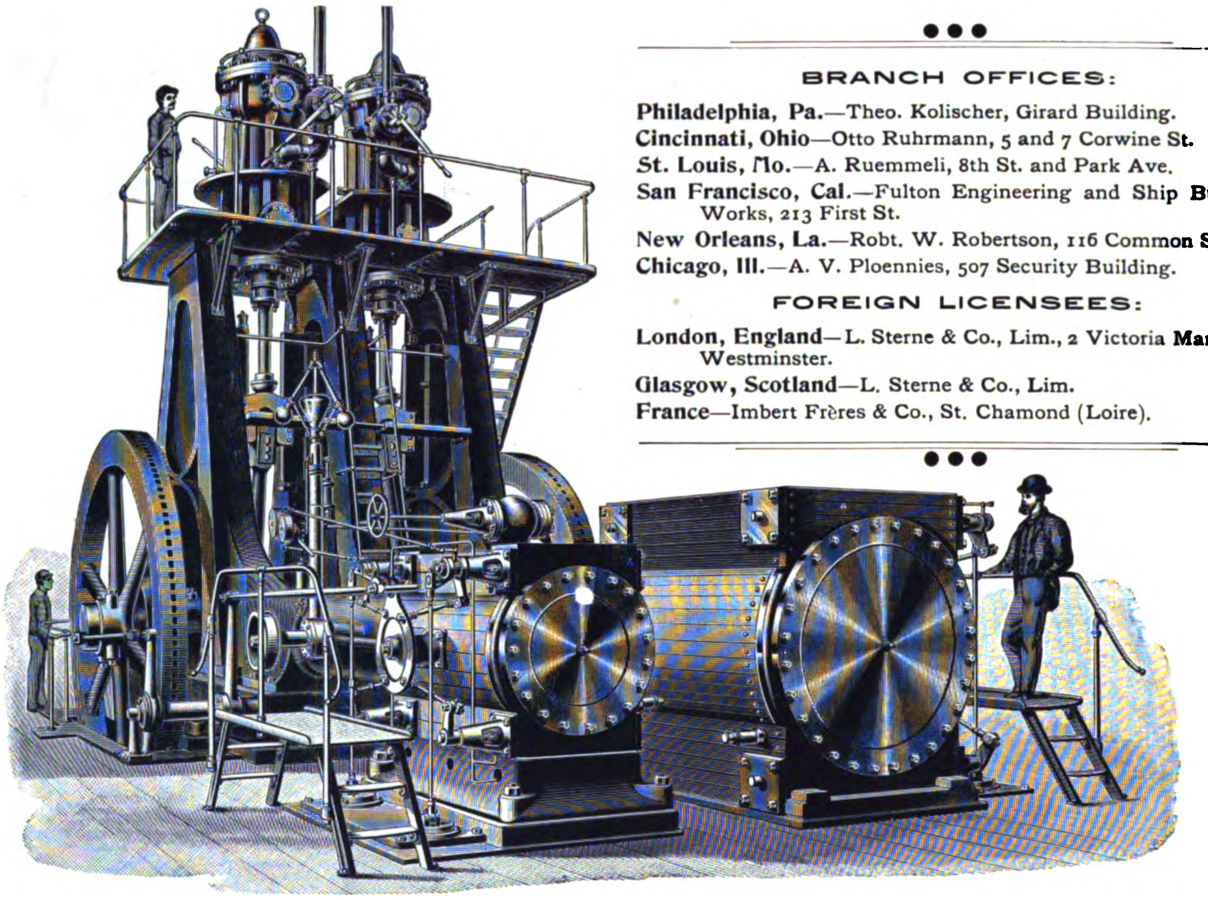
AND OF ANHYDROUS AMMONIA.

BRANCH OFFICES:

Philadelphia, Pa.—Theo. Kolischer, Girard Building.
Cincinnati, Ohio—Otto Ruhrmann, 5 and 7 Corwine St.
St. Louis, Mo.—A. Ruemmeli, 8th St. and Park Ave.
San Francisco, Cal.—Fulton Engineering and Ship Building Works, 213 First St.
New Orleans, La.—Robt. W. Robertson, 116 Common St.
Chicago, Ill.—A. V. Ploennies, 507 Security Building.

FOREIGN LICENSEES:

London, England—L. Sterne & Co., Lim., 2 Victoria Mansions, Westminster.
Glasgow, Scotland—L. Sterne & Co., Lim.
France—Imbert Frères & Co., St. Chamond (Loire).



500-TON REFRIGERATING MACHINE, THE LARGEST EVER BUILT.

NUMBER OF MACHINES IN OPERATION JANUARY 1st, 1894.

Breweries,	318	Machines.
Ice Factories,	48	"
Abattoirs and Packing Houses,	43	"
Markets and Cold Storage Houses,	26	"
Hotels,	10	"
Chemical Works,	7	"
Chocolate Factories,	7	"
Steamships,	6	"
Mineral Water Factories,	1	"
Scientific Institutions,	3	"
TOTAL,	469	Machines

Representing a Total Refrigerating Capacity of over 26,000 Tons of Ice melted every 24 hours.

CORRESPONDENCE SOLICITED. WRITE FOR PAMPHLETS.